# THE REAL THING.

## A Safe Step Forward – The Challenges of Determining the Reaction to Fire Characteristics for Data Communication Cables

Draka

A brand of the Prysmian Group

## INTRODUCTION

Fire in buildings is a significant safety risk and there is duty of care for all parties involved with the specification and supply of cable products to ensure that the risk is suitably mitigated. Cables permanently installed in any type of building and civil works are subject to the Construction Product Regulation (CPR) EU 305/2011, which was fully implemented for cable products as of 1st July 2017. Since that date it has been mandatory for all permanently installed cables placed on the market in Europe to be CE marked for reaction to fire safety performance characteristics. Authorities, Specifiers, Wholesalers and Installers all have responsibilities for safety in the case of fire and compliance with the CPR

## EN 50575 FOR THE CPR

The CPR covers any materials intended to be incorporated in construction works and prescribes seven basic requirements which include; mechanical resistance and stability, hygiene, health and the environment and energy economy and heat retention. However, for data communication cables the most important requirement is safety in case of fire.

EN 50575 is a harmonised European standard for cables in construction works subject to reaction to fire requirements under the CPR. The standard specifies reaction to fire performance requirements, test and assessment methods.

EN50575 clearly sets out everything required of a manufacturer. Within the CPR a "manufacturer" is anyone who owns a brand (naming to show ownership). This includes distributors wanting to run both Assessment and Verification of Constancy of Performance (AVCP) systems 1+ and 3 to mark their products. Whilst manufacturers will continue to undertake pre-design product testing internally, independent third party testing organisations (known as Notified Bodies) test the reaction to flame and release of dangerous substances (e.g. smoke). This is not only to the pre-design testing level, but also to check-gain results are as expected. The CPR requires that every three years already classified products are retested by a Notified Body for system 1+. Should a product not achieve the stated class it will automatically go into a non-conformance procedure.

To gain a Declaration of Performance (DoP), a prerequisite for CE marking the steps required are clear; enforcement of specific testing to classify each cable is described at every level.

The consequences of not carefully following the procedures and test alignment are swift and severe: the product will be traced and removed from the market, including product already installed. Most manufacturers running a Factory Process Control (FPC), as demanded by system 1+, will have tested the same product every year, reducing the risk that up to three years of deliveries will not automatically be required to be returned.

The same can be said for distributors as they too are under system 1+ and should then be carrying out all the procedures demanded by the FPC audit and EN 50575

## FLAME TEST EN50399 – UNDERSTANDING THE FIRE CHARACTERISTICS OF DATA CABLE

The EN50399 integrated flame test provides the reaction to fire characteristics for the CPR. Reaction to fire characteristics that are collected during the test include rate of heat release, flame spread, smoke, total heat release and droplets (burning drops of plastic that spread fire): acidity is tested later using another rig. When all testing is successfully completed and a cable's characteristics collected, they are used to determine the fire class of the cable. For data cables this ranges from Euroclass $F_{ca}$ for cables which have a very high reaction to fire, through $E_{ca}$, $D_{ca}$, $C_{ca}$ to $B2_{ca}$. Euroclass $B2_{ca}$ cable products have a very low reaction to fire and will not self-propagate a flame if ignited.

With the introduction of the CPR for cables Draka Multimedia Solutions (MMS), a part of Prysmian Group, assessed their own internal fire test rigs. The Draka MMS cable engineering team found that test rigs required some local modifications to improve the calibration of air flow, flame and gas/air mixing and align the performance. Once this knowledge was taken on board it was decided that a cautious strategy would be adopted, choosing the more conservative results as the guide to designing products. The Draka MMS fire test rigs have all been fully converted to comply with the new EN50399 integrated flame test standard.

Certain data communication cable products were consistently found to struggle to achieve the expected results of the market (minimum $C_{ca}$) and be capable of meeting mechanical performance. This is mainly due to the high amount of polyethylene in the cable construction. With this knowledge, the Draka MMS engineering team took the decision to adopt a safe approach to data communication cable fire safety testing. The aim of this approach was to reduce the risk of incorrect collated characteristics when the product was being tested by a third-party laboratory, and even more so when the same cable is involved in regulatory market surveillance.

Like other European leading companies Prysmian will never compromise on safety which is the ultimate goal of CPR.

## EN50399 TEST RESULTS

The Draka MMS team in the UK has found evidence where the classification of cable products used in the data communications structured cabling industry appear to indicate very good results where they would not typically be expected.

In late 2018 The MMS team commissioned a 3rd party laboratory to conduct a standard EN50399 test on a Category 6 U/UTP data cable. The cable, with a highest rating for a PE based design, $B2_{ca}$, was procured from a third-party cable manufacturer (with their knowledge that the product would be flame tested) and was supplied on a reel. The result of the independent re-test was that the cable barely achieved class $D_{ca}$, let alone reaching the requirements for $B2_{ca}$ classification, which was passed onto the manufacturer.

To meet the requirements for flame spread at $B2_{ca}$ level the flames should not have progressed past the second ladder rung above the point of ignition (1.5metres flame spread). To meet $C_{ca}$ requirements the flame should not spread further than the third rung of the ladder (2.0 metres spread). The flame spread did not meet the requirements for both $B2_{ca}$ and $C_{ca}$ by a considerable margin with charring of the cable to nearly the top of the test rig. The cable also only achieved a $D_{ca}$ rating for the Peak Heat Release, Total Heat Release and Fire Growth Rate measurements in the test. This is very worrying as it indicates the risk for a fire hazard in the installation.

In early 2019 Draka MMS organised a second test by a different 3rd party laboratory. The lab was asked to conduct a standard EN50399 test on a commercially available Category 6 U/ UTP cable, supplied in Reelex™ box format with a $B2_{ca}$.

Figure 1 shows the cable ready in the chamber prior to the start of the test. The cable is of identical construction to the first example tested in December 2018, the only difference is that it has been loaded into a box using the Reelex™ process.

Figure 3 shows the state of the burning cable at approximately 1-minute intervals from the start of the test.

Figure 2 shows that the cable post-test once extinguished. The cable burnt to the top of the test rig within six minutes and clearly failed to meet the requirements for either $B2_{ca}$ or $C_{ca}$ classification. The true classification of the cable would be at best $D_{ca}$.

The cable was tested for a second time in an identical manner by a different laboratory, and the same result was observed with the cable burning the full height of the test rig and failed to achieve the $B2_{ca}$ classification stated on the DoP.

Figure 1 and 2 -Market Surveillance Testing (EN50399) of a non-Draka Category 6 U/UTP „$B2_{ca}$“ classified cable (supplied in a Reelex box)

## THE EFFECTS OF PRODUCTION ON FIRE SAFETY PERFORMANCE

While working on a new Category 6 U/UTP cable, which would be fully CPR compliant to a minimum of $C_{ca}$ classifications, the MMS team discovered another important factor which can affect fire testing result for a cable. Cable which runs off the production line straight onto a reel retains its 'as manufactured' structure and integrity, but the treatment of the cable to load it into a box without a reel (by processes such as Reelex™) is a different matter.

In these circumstances, the cable sheath is physically deformed, which can have a significant negative impact on the resulting EN13501-6 Euroclass classification achieved by the cable. The difference between the EN13506-6 classifications of reeled and Reelex™ box cable became apparent to the MMS team through the course of conducting multiple internal EN50399 tests on new Category 6 U/UTP cable designs.

This phenomenon is already well known as the same effect is seen on transmission tests as well as mechanical.

Figure 4 shows an example of one of multiple EN50399 tests conducted internally by Prysmian Group with D64. This test used cable from the inner most section of a Reelex box, where the indentions induced in the sheath by the box loading process is the most severe and so represents the worst-case condition of cable when installed.

In this example, the cable successfully achieved a $C_{ca}$ classification, as it did in multiple other internal tests. These results have been repeated externally by two laboratories to confirm a CPR classification of $C_{ca}$.

Figure 3 - Photo sequence showing the test progression of the cable shown in figs 1 and 2 - Time scale from left to right is < 6mins

Figure 4 - Draka Category 6 U/UTP $C_{ca}$ D64 Cable Successfully Achieving Euroclass $C_{ca}$ Classifiction in a EN50399 Test

## POTENTIAL RAMIFICATIONS OF INSTALLING MIS-CLASSIFIED CABLE

Two years ago, we witnessed 1.5 million metres of Category 6 U/UTP flame retardant cable installed into a new hospital. November 2017 saw the introduction of BS6701:A1 (British Standard for Telecommunications equipment and telecommunications cabling - Specification for installation, operation and maintenance) which included the recommendation that all new installed permanent cabling shall be Euroclass $C_{ca}$. Hence, it is easy to envisage that a similar hospital installation now would require a minimum of $C_{ca}$ and possibly even $B2_{ca}$ cabling to be installed. The high classification cable is required to help minimise the speed at which a fire spreads and the amount of smoke that is created; both are factors which need to be controlled as much as possible to give the patients and staff as much time as possible to evacuate the building.
If all the cable installed at the hospital was $B2_{ca}$, as specified, the total heat release it would contribute to a fire would be approximately 11,719MJ (megajoules). However, if that cable had been incorrectly rated, the flame spread would be far more extensive. If, for example, it was only $D_{ca}$ rated, the potential heat release could be up to 900,000MJ–a staggering difference! Figure 5 shows a graphical representation of the percentage difference between each of the CPR test parameters for $B2_{ca}$, $C_{ca}$ & $D_{ca}$ classifications.

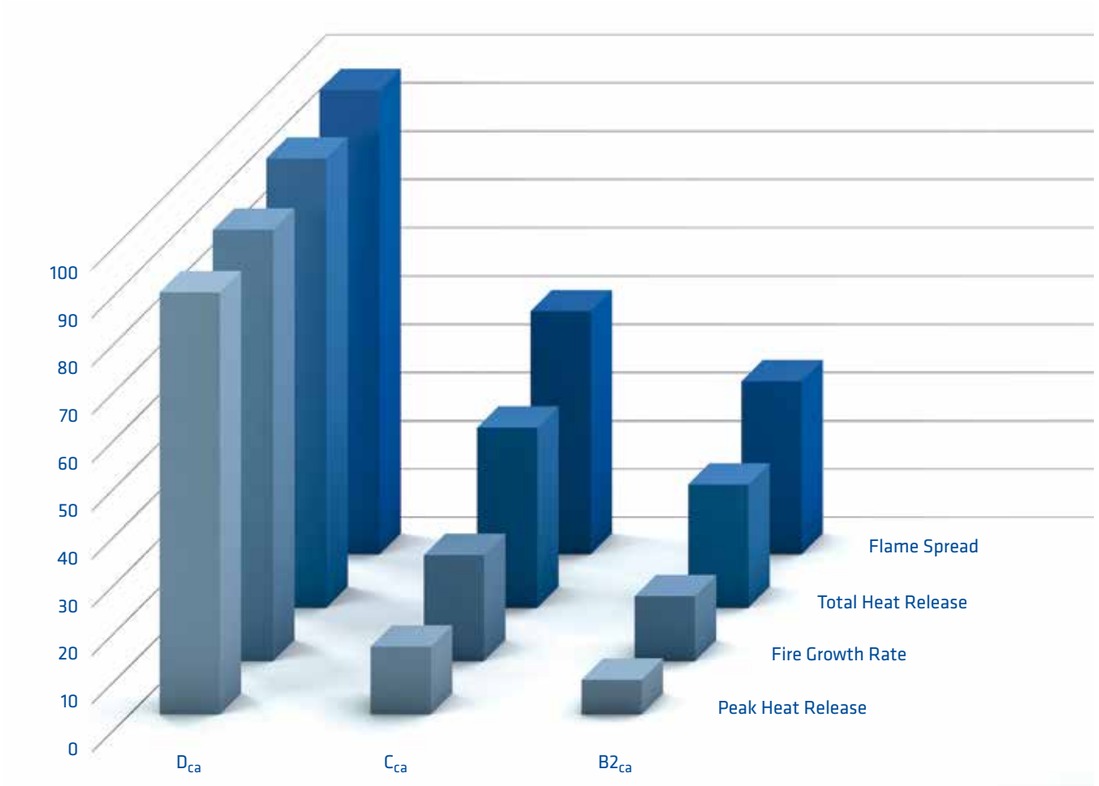
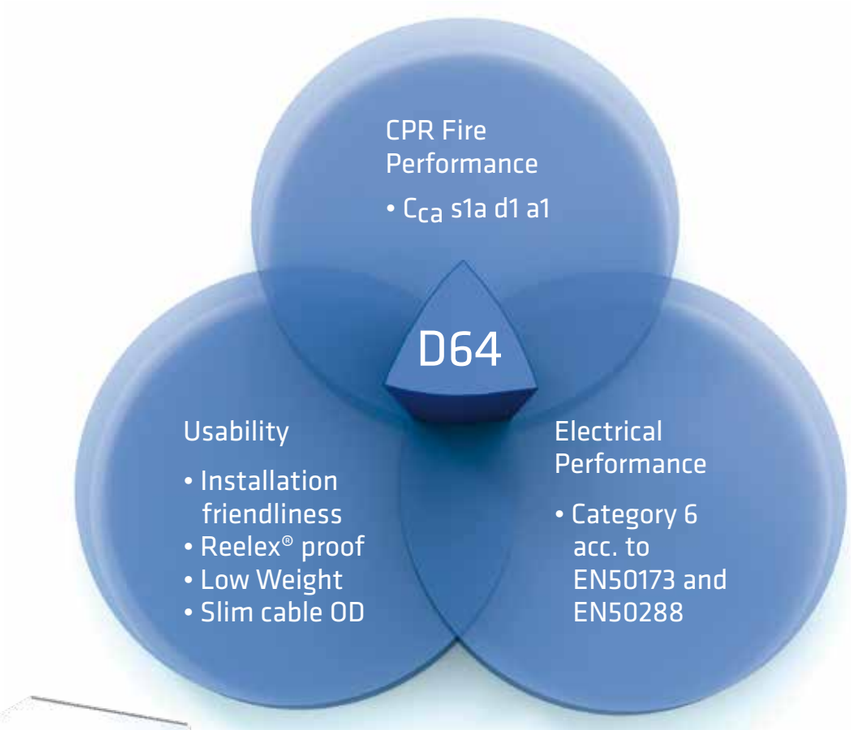



Figure 5 - Differences Between CPR Fire Test Criteria

## DRAKA D64 - KEEPS WHAT IT PROMISES





To demonstrate the complexity of the problem, the Multimedia Solutions team, has spent the past 18 months working on solving the challenge of manufacturing a Category 6U/UTP product with a minimum Euroclass $C_{ca}$ rating. In isolation this requirement is relatively easy to achieve, but for the cable to meet the rigorous demands of the cable installation industry further development was necessary. A new higher Euroclass rated cable needs to mirror the features of the standard $E_{ca}$ product which it will replace. This means it still needs to be easy to install, with a slim outside diameter (<6mm), low weight and suitability for Reelex packaging into a standard 305m box.

Multiple designs were created which achieved a $C_{ca}$ classification but did not meet the installation criteria. For example, a design version with a layer of glass tape under the sheath performed well in the fire testing but had a large diameter which made it too big and heavy to supply in the Reelex box format. It was found that even the internal construction of the cable can have a significant impact on the fire safety performance of a cable. For instance, the cable could have the pockets of air between the twisted pairs reduced to limit the flame spread, but in doing so can negate the ability to transmit data in accordance with the EN50173 and EN50288 standards. These effects are also seen with foil screened desighs – the assumption should never be that foiled designs will pass any easier unless properly checked.

Version 09.2019 V2

## IN SUMMARY

Fire Engineers, designing buildings meeting fire regulations, ensuring that fire characteristics can be verified, by fire test engineers within the cable industry is a necessity: it is incumbent, upon us all in this sector, to engage and take greater responsibility.

Guidance is given from stakeholders in the qualification process to ensure that correct testing and factory processes are implemented. The ultimate responsibility is in the hands of the CPR manufacturer as stated on the DoP.

CPR has been introduced to the cable sector for all the right reasons and there is without a doubt a feeling that the work conducted under CPR has made people's lives safer. However, the question must be asked, what steps has a manufacturer taken to ensure that a data communication cable produces very good flame test results and fully complies with the requirements of Category 6/6A etc. transmission? Ultimately the safety of people's lives should be paramount in the minds of all those involved in the specification, supply and installation of data communication cables into occupied buildings.

Draka

A brand of the Prysmian Group

**Draka Comteq UK Limited**
**Crowther Industrial Estate**

Crowther Road, Washington
Tyne & Wear NE38 0AQ | United Kingdom.
Phone: +44 (0) 2380 295552
draka.mms@Prysmiangroup.com
uk.prysmiangroup.com

**Draka Comteq Germany GmbH & Co.KG**

Piccolominstr. 2
51063 Cologne | Germany
Phone: +49 (0) 221 67 70
multimedia@prysmiangroup.com
www.prysmiangroup.com