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Fire performance of communication cables installed in buildings

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FOREWORD

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IEC 62222, which is a technical report, has been prepared by subcommittee 46C: Wires and symmetric cables, of IEC technical committee 46: Cables, wires, waveguides, r.f. connectors, r.f. and microwave passive components and accessories

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
46C/633/DTR	46C/662/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

FIRE PERFORMANCE OF COMMUNICATION CABLES INSTALLED IN BUILDINGS

1 Scope and object

The object of this technical report is to provide recommendations for the requirements and test methods to be specified for the fire performance of communication cables when installed in buildings.

The recommendations relate to typical applications and installation practices for copper and optical cables in buildings. This technical report includes an assessment of the fire hazards presented by such installations, and describes fire scenarios that have been established and the appropriate cable fire performances to mitigate these hazards.

The recommendations also take into account legislation and regulation applicable to the fire performance of cables, the results of known research work and an assessment of known test methods and their ability to measure the recommended fire performance.

Power cables are usually segregated from communication cables for electrical safety and installed differently so they have not been addressed in this technical report.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60332-1-1, *Tests on electric and optical cables under fire conditions – Part 1-1: Test for vertical flame propagation for a single vertical insulated wire or cable – Apparatus*

IEC 60332-1-2, *Tests on electric and optical cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame*

IEC 60332-3-10, *Tests on electric and optical cables under fire conditions – Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables – Apparatus*

IEC 60332-3-24, *Tests on electric and optical cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C*

IEC 60695-5-1, *Fire hazard testing – Part 5-1: Corrosion damage effects of fire effluent – General guidance*

IEC 60695-5-3, *Fire hazard testing – Part 5-3: Corrosion damage effects of fire effluent – Leakage current and metal loss test method*

IEC 60695-6-1, *Fire hazard testing – Part 6-1: Smoke opacity – General guidance*

IEC 60695-7-1, *Fire hazard testing – Part 7-1: Toxicity of fire effluents – General guidance*

IEC 60754 (all parts), *Test on gases evolved during combustion of materials from cables*

IEC 60794 (all parts), *Optical fibre cables*

IEC 61034(all parts), *Measurement of smoke density of electric cables burning under defined conditions*

IEC 61156 (all parts), *Multi-core and symmetrical pair / quad cables for digital communications*

ISO/IEC 11801, *Information Technology – Generic cabling for customer premises*

ISO/IEC 13943, *Fire safety – Vocabulary*

ISO 9705, *Full-scale room test for surface products*

EN 13823, *Reaction to fire tests for building products – Building products, excluding floorings, exposed to the thermal attack by a single burning item.*

EN 13501-1, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests.*

EN 50265-2-1, *Common test methods for cables under fire conditions – Test for vertical flame propagation for a single insulated wire or cable – Part 2-1: Procedures – 1 kW pre-mixed flame*

EN 50266-2-4, *Common test methods for cables under fire conditions – Test for vertical flame spread of vertically-mounted bunched wires or cables – Part 2-4: Procedures – Category C*

EN 50267-2-3, *Common test methods for cables under fire conditions – Tests on gases evolved during combustion of materials from cables – Part 2-3: Procedures – Determination of degree of acidity of gases for cables by determination of the weighted average of pH and conductivity*

EN 50289-4-11, *A horizontal integrated fire test method*

CSA FT4, *Canadian Standards Association, CSA 22.2 No. 03-01 "Vertical flame test – Cables in cable trays"*

CSA FT6, *Canadian Standards Association, CSA 22.2 No. 03-01 "Horizontal flame and smoke test"*

NES 713 UK *Ministry of Defence Standard 02-713 (NES 713), "Naval Engineering Standard – Determination of the toxicity index of the products of combustion from small specimens of materials"*

NFPA 262, *Standard method of test for flame travel and smoke of wires and cables for use in air handling spaces. (Formerly UL 910)*

UL 1666, *Underwriters Laboratories, Inc., "Test for flame propagation height of electrical and optical fibre cables installed vertically in shafts"*

UL 1685, *Underwriters Laboratories, Inc., "Standard for vertical tray fire propagation and smoke release test for electrical and optical fibre cables"*

UL VW-1, *Underwriters Laboratories, Inc., "VW-1 (vertical specimen) flame test – UL 1581, Reference standard for electrical wires, cables and flexible cords"*

3 Terms, definitions and abbreviations

For the purpose of this technical report, the definitions in ISO/IEC 13943, together with the following (some of which are based on EN 13501-1) apply.

3.1
BRE
Building Research Establishment

3.2
"Cardington" test rig
real-scale scenario for cables in horizontal hidden voids in buildings, developed by the BRE in the Partners in Technology project [5][1]

3.3
CENELEC
European Committee for Electrotechnical Standardisation

3.4
CFRA
Cable Fire Research Association [11] [16]

3.5
contribution to fire
energy released by a product influencing the fire growth

3.6
CPD
Construction Products Directive [3]

3.7
CSA
Canadian Standards Association

3.8
EN
European Standard

3.9
end use application
real application of a product in relation to all aspects that influence the behaviour of that product under different fire situations

3.10
FEP
Polytetrafluoroethylene, Fluorinated ethylene-propylene or Polytetrafluoroethylene-hexafluoro-propylene

3.11
fire growth rate index
FIGRA
maximum quotient of heat release rate from a specimen and the time of its occurrence

[1] Numbers in square brackets refer to the Biliography.

3.12
FIPEC
Fire Performance of Electric Cables [7]

3.13
fire situation
stage in the development of a fire, characterised by the nature, severity and size of the thermal attack on the products involved

3.14
flaming droplets
material separating from a specimen during a fire test and continuing to flame for a minimum period as described by the test method

3.15
HF
halogen free or Low smoke zero halogen (sometimes known as LSOH)

3.16
HR
Heat Release

3.17
HRR
Heat Release Rate

3.18
ISO
International Standards Organisation

3.19
LC_{50}
concentration or volume fraction of gas or fire effluent statistically calculated from exposure data to produce lethality in 50 % of test animals within a specified exposure and post-exposure time

3.20
LSPVC
Low Smoke Flame Retardant PolyVinylCchloride

3.21
NEMA
National Electrical Manufacturers Association [2]

3.22
NES
Naval Engineering Standard

3.23
NFPA¨
National Fire Protection Association

3.24
NIST
National Institute of Standards and Technology [10]

3.25
OD
Optical Density

3.26
PCS
Gross Calorific Potential

3.27
PE
Polyethylene

3.28
PII
Partners in Innovation [6]

3.29
PIT
Partners in Technology [5]

3.30
PP
Polypropylene

3.31
PVC
Polyvinyl chloride

3.32
PVDF
Polyvinylidene Fluoride

3.33
reaction to fire
response of a product in contributing by its own decomposition to a fire to which it is exposed, under specified conditions

3.34
reference scenario
hazard situation and environment used as a reference for a given test method

3.35
SBI
Single Burning Item test (EN 13823)

3.36
small fire attack
thermal attack produced by a small flame such as a match or lighter

3.37
smoke growth rate index
SMOGRA
the maximum quotient of smoke production rate from a specimen and the time of its occurrence

3.38
smoke hazard
potential for injury and/or damage from smoke

3.39
smoke
visible part of fire effluent

3.40
SP
Smoke Production

3.41
SPR
Smoke Production Rate

3.42
THR
Total Heat Release

3.43
TSP
Total Smoke Production

3.44
UL
Underwriters Laboratories Inc.

4 Typical communication cable installations

In order to define the appropriate fire test methods and performance requirements, it is necessary to consider the fire hazards presented by typical cable installations.

During the last decade, the worldwide demand for more and more information has resulted in increasing transmission data rates, and developments in local area networks (LANs). In particular the growing popularity of structured cabling systems as defined in ISO/IEC 11801 has given rise to new types of installations. The generic structured wiring cabling system is a hierarchical star network linking campus distributors to different building distributors, which in turn link to individual floor distributors which then connect with telecommunication outlets. On each floor, the riser cable, run in vertical shafts, connects to the floor distributor which transmits data via the horizontal cables to each floor outlet. In a typical installation, the floor outlets are arranged in a matrix layout spaced about 1 or 2 metres, with the horizontal cables run in ceiling or under-floor voids. Even in a small office, this leads to a large number of cables run in building voids, particularly near the floor distributor.

The evolution of Structured Wiring has coincided with a rapid increase in system data rates, from 10 kbps in the early 1980's to 600 Mbps in the late 1990's, and on to 1,2 Gbps in the early 2000's. As transmission rates increase, system upgrades to higher performance cables and components are typically necessary. Since old redundant cables are rarely removed before new cables are installed, frequent upgrades result in a large amount of many generations of cables accumulating in building voids.

Copper conductor cables manufactured to the IEC 61156 series and optical cables manufactured to the IEC 60794 series are used in Structured Wiring. These standards detail electrical and optical transmission requirements, mechanical performance and environmental characteristics. Optical cables and communication cables operating at low voltages and currents are not a primary cause of fires, but their widespread use means that they may be involved in outbreaks of fire from an external source. Therefore, fire performance is one of the most important environmental parameters to be specified.

A review of typical installations suggested that communication cable installations in buildings are as shown in Annex B and can be grouped into the following descriptions: