Why are cable flame tests important?

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A JOURNEY THAT BEGAN TWO CENTURIES AGO

1879 — ESTABLISHMENT
Company founded as "**Pirelli** Cavi"
Establishment of first operation in Italy

1902 — ORGANIC GROWTH
Organic growth
Product range enlargement
Internationalization

1910 — FOUNDATION
Founded in Netherlands as "Hollandsche Draad & Kabel Fabriek"

1970 — GROWTH BY ACQUISITION
Acquired by Philips as part of the Wire and Cable division

1986 — INDEPENDENCE
Independent through a buyout financed by Parcom and Flint Beheer: the name Draka was born

1987 — RESTRUCTURING PROCESS
Closure of 11 plants
Disposal of non core activities

1998 — GROWTH BY ACQUISITION
Acquisitions (Siemens, NKF, MM, BICC)

EXTERNAL GROWTH
A spree of global acquisition over a 20 year period followed including Philips Optical Fibres and Alcatel

2001 — PROFITABLE GROWTH
July 28, '05
Goldman Sachs acquisition and birth of **Prysmian**

2005 — LISTING
May 3, '07 Listing on the Milan Stock Exchange (IPO)

2007 — STRATEGIC INVESTMENTS
Managing the downturn

2011 — BIRTH OF THE PRYSMIAN GROUP
Merger between Prysmian and **Draka** and creation of the worldwide leader of the cable industry

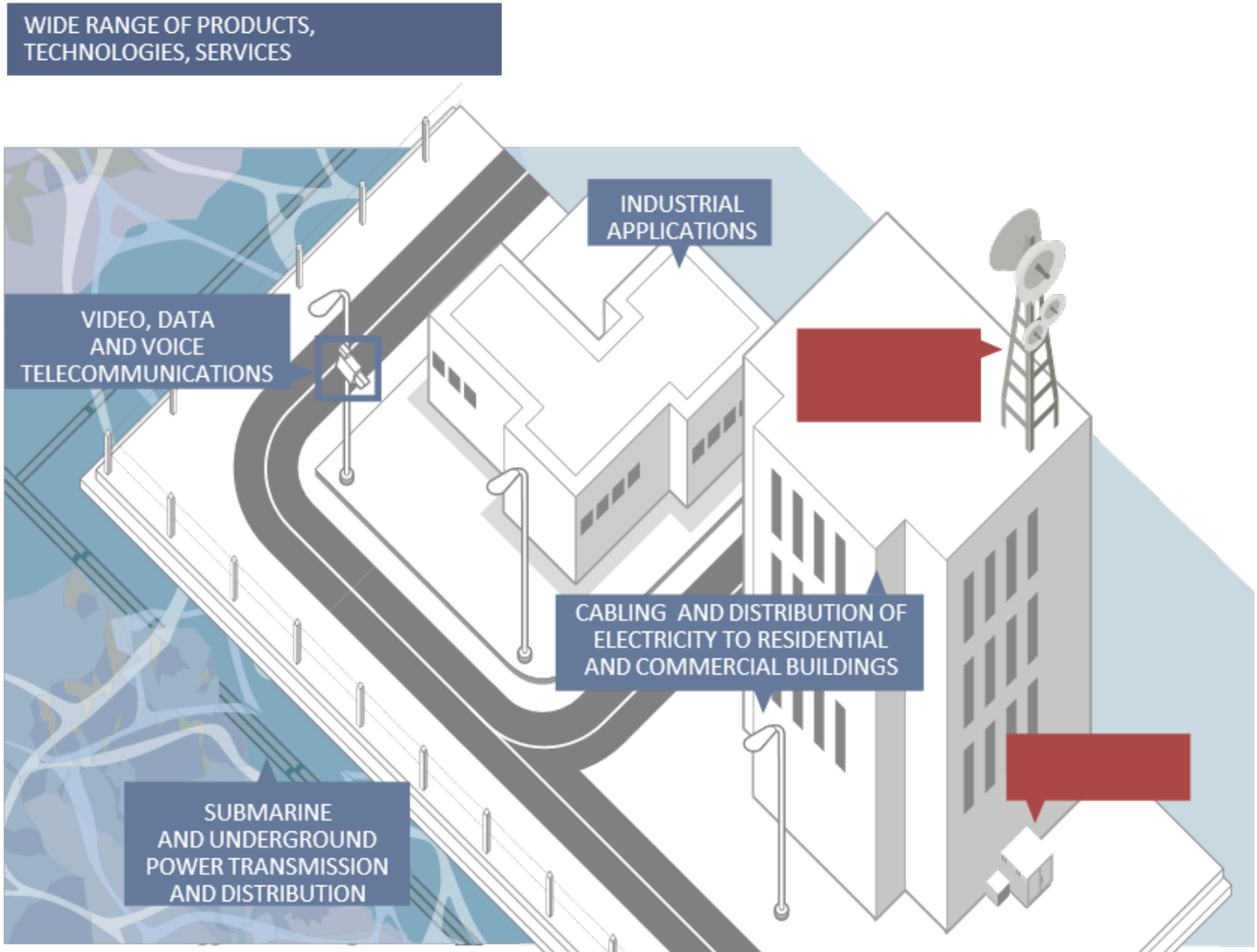
2012/16 — NEW ACQUISITION
General Cable

2018

PRYSMIAN
Draka
PRYSMIAN
General Cable
Prysmian Group
 # 1 CABLE MAKER
Draka
Bicsi

OUR BUSINESS

World leader in the energy and telecom cables and systems industry, partner of the world's key players



MAJOR PROJECTS

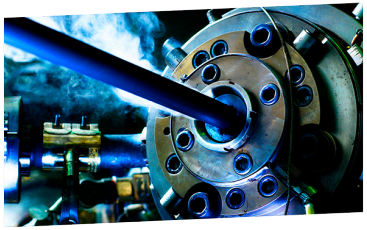
STATE-OF-THE-ART SUBMARINE POWER LINKS

Submarine power links for utilities and grids, such as the **Western HVDC Link** from Scotland to England, which will operate at the record voltage level of 600 kV

LEADER IN OFFSHORE WIND FARMS

World leader in offshore wind farm connections, including the landmark Germany's **DolWin3** project in the North Sea, with a record power rating of 900 MW

UNDERGROUND CABLES



HVDC underground cable systems leadership.

Also, successfully tested and installed P-Laser cable, the first-ever **eco-sustainable High Voltage cable** for electrical grids

CABLES FOR ARCHITECTURAL LANDMARKS

Group's fire-resistant cables lie at the core of spectacular constructions like the **Burj Khalifa** in Dubai, the world's tallest building

MAJOR PROJECTS

TACKLING THE HARSHEST ENVIRONMENTS

The Group has taken part in **several O&G projects** designing and supplying high-tech umbilical products and flexible pipes for offshore oil extraction, reaching 2,000 m below the sea

POWERING ELEVATORS

Our cables power elevators in some of the world's tallest and most prestigious buildings, such as the **World Trade Centre** currently being completed in New York City

TRAINS, SHIPS, SUBWAYS AND PLANES

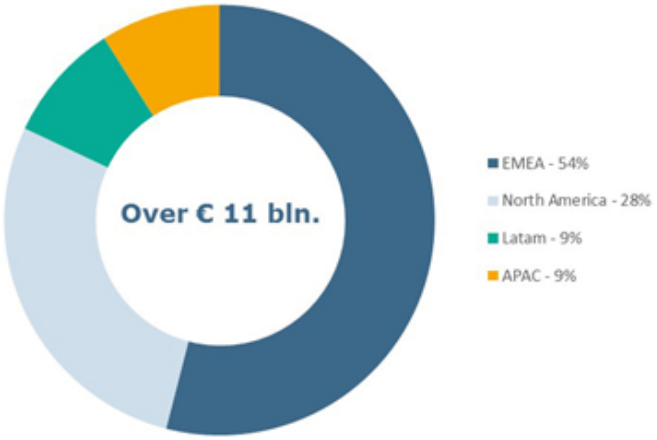
Prysmian has cabled some of the world's largest aircraft and ships, such as the **Airbus 380** and Royal Caribbean's **GENESIS fleet**, as well as the **fastest trains** and most innovative subways

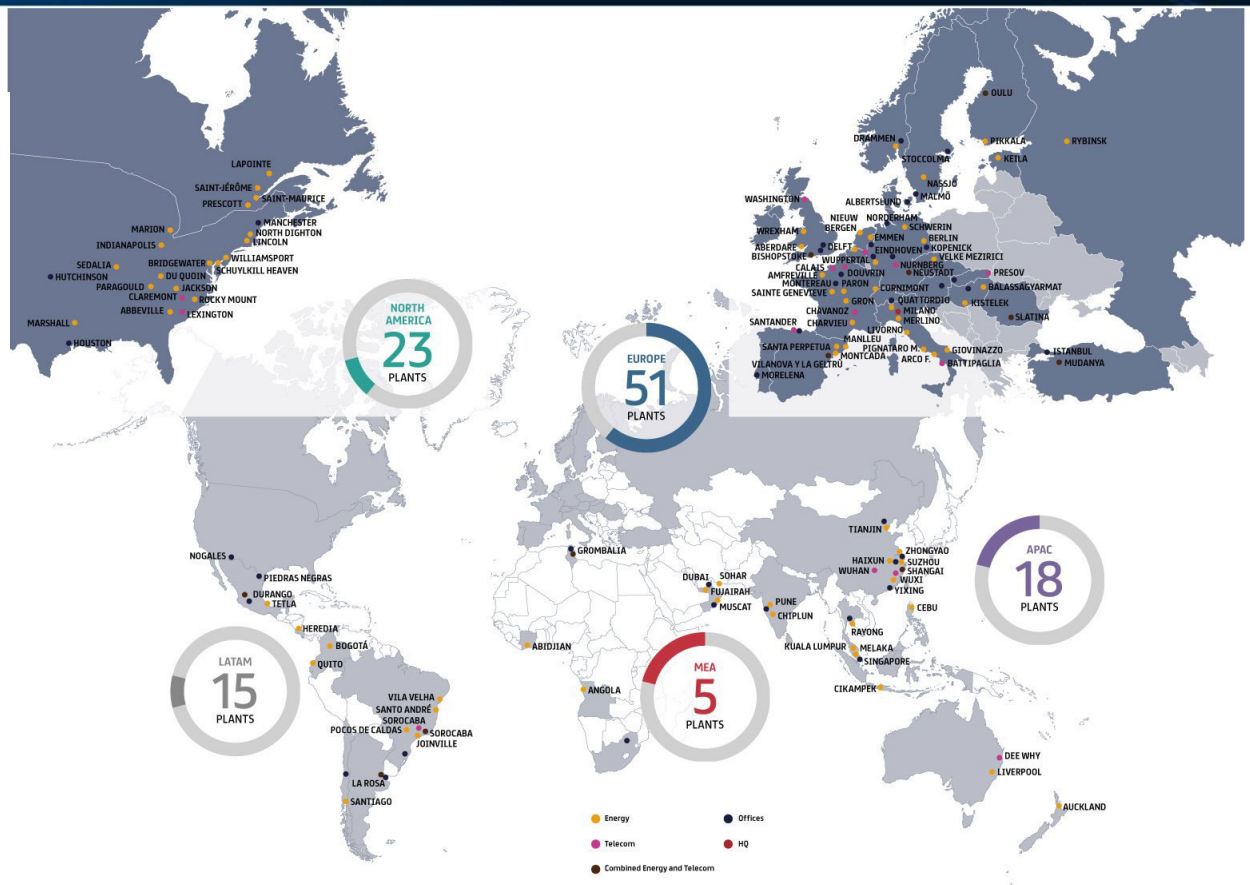
CONNECTING CONTINENTS

Prysmian Group is working with the Australian government to create a Fibre-to-the-Premises network, **bringing broadband to 93% of Australia**

A TRULY GLOBAL GROUP

Sales breakdown by Geography





Almost **140** years of history

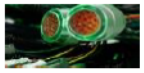
> 50 countries

112 plants

About **30,000** employees

About **>11** billion sales in 2017

OUR SOLUTION PORTFOLIO

	Trade & Installers	Power Distribution	Specialty	Others
	€3,2 bn	€2,1 bn	€1,0 mn	€1,6 mn
Key Products	Copper and Aluminum Building Wire  LV & MV Power Cable  Control, Power, Automation, and Instrumentation Cable  Electronics Cable 	LV, MV and Wind Distribution Cable  Bare Aluminum Conductor  OPGW  Terminations, Splices, and Accessories 	Aluminum Rod & Strip  Industrial Wire Harness and Assemblies  Transit Wire and Cable  Mining, OGP, Military, Nuclear, and other Specialty cables 	Automotive  O&G  Elevators  Network Components 
Key Brands	CAROL BRAND, exZhellent, POLYRAD, STABILOY BRAND, Draka, NUAL BRAND	PRYSMIAN CABLES & SYSTEMS, ARMIGRON, ALL GROUND, TransPowr with E3X TECHNOLOGY	lifeline, PRYSMIAN CABLES & SYSTEMS, GENFIRE, ANACONDA BRAND, ULTROL 60+, POLYRAD	Draka, exZhellent, ClickFit, NSW BRAND, PRYSMIAN CABLES & SYSTEMS, Prestolite electric

Bicsi

A full burn out! Why: How important is this?

- TR62222 - describes the test methods for various parameters relating to the reaction to fire properties of metallic and optical fibre communications cables. The parameters have particular importance for cables intended to be installed within buildings and other structures.
- This document also maps the test methods, and associated limits applied, to the fire hazards created by particular installation conditions and which may be referenced by other international, regional and national standards. For example, compliance with the requirements and recommendations for installation methods in ISO/IEC 14763-2 taking into consideration this Technical Report should improve safety concerning fire

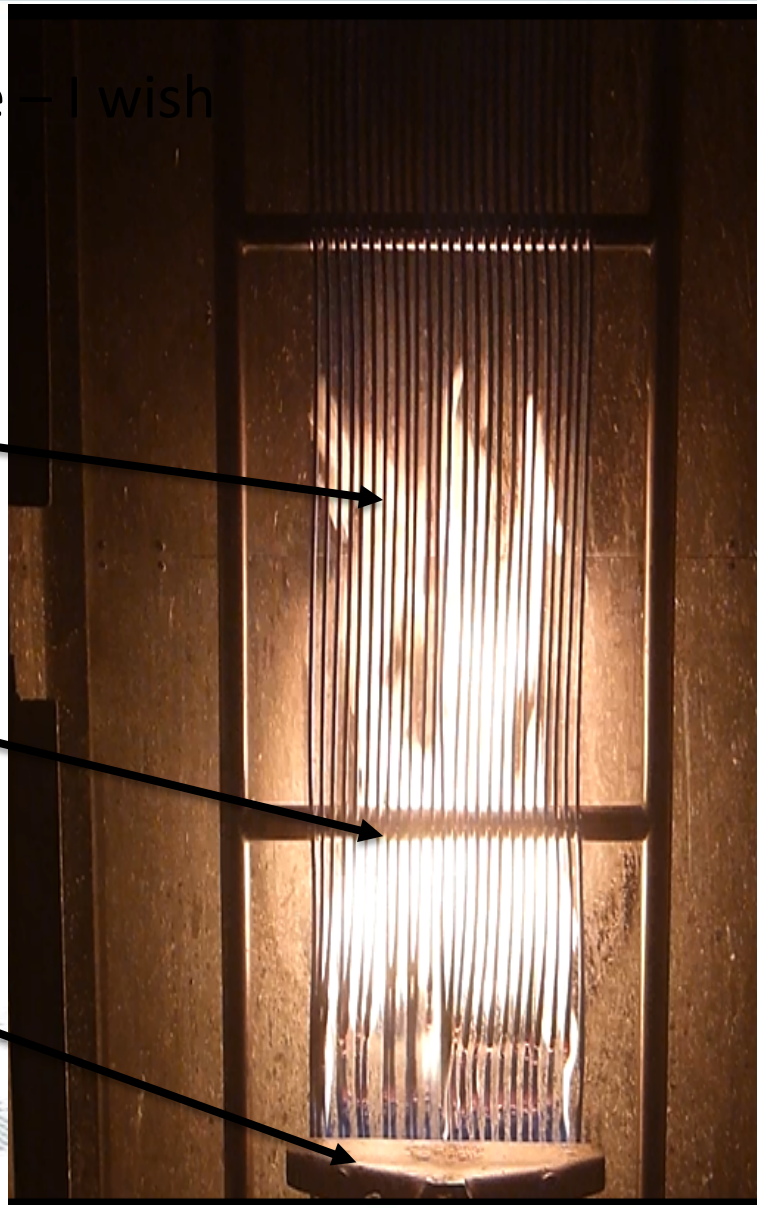
Flame testing – first 60 seconds

- My Mum told me not to play with fire – I wish I'd listened to her!

Flame height as expected and soon to be standardised…

Ladder loaded with single cable spaced

Typical standardised burner giving 20.5Kw of heat



Some examples of flame testing issues.

A good flame shape and height

Blue flame distance from burner correct

Checked with a burnt board marker (wood plate profile)

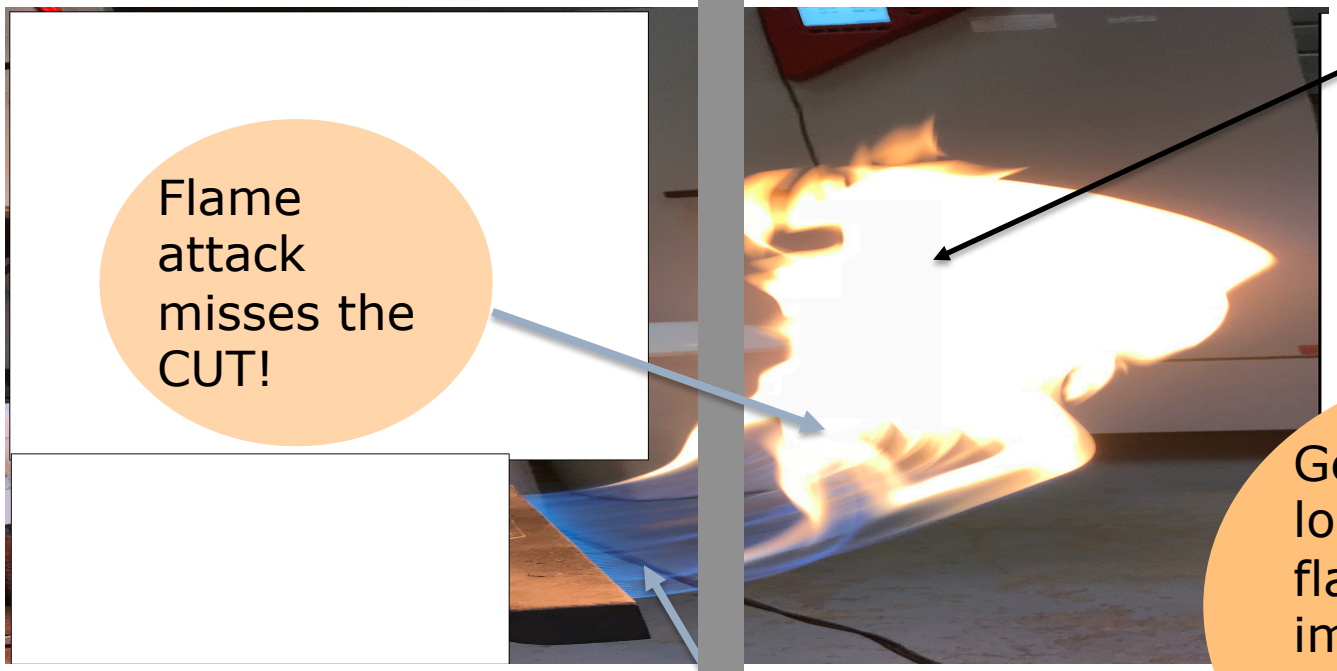
Some examples of flame testing issues.

A good flame shape and height

Ladder with CUT having full flame attack

Blue flame distance from burner correct

Some examples of flame testing issues.



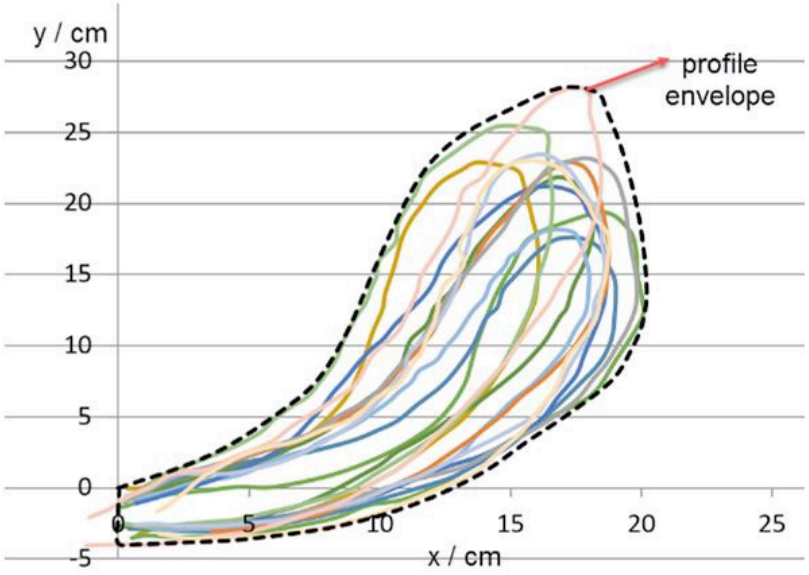
Flame attack misses the CUT!

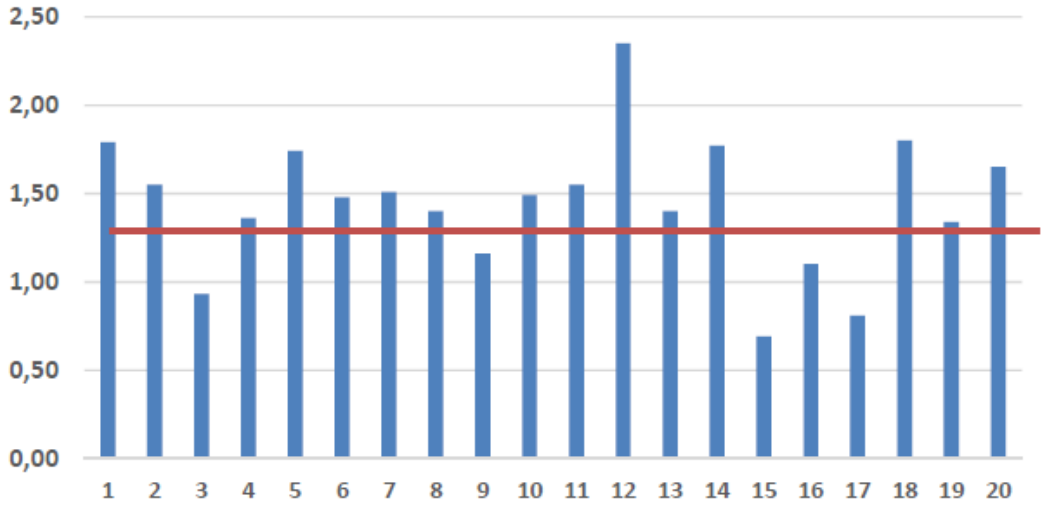
A poor flame shape and too low

Generally causes low FS and HR – flame not impinging on the sample to be tested

Blue flame too long

Challenges: deviating flame shapes and reproducibility of the tests





- air flow management in the burner
- deviating burner types and dirty burner holes
- absence of specified venturi gas mixer in some labs
- different insulation of test chambers
- no control of air flow through the test chamber
- air leakages of the test cabinet
- obstacles for air flow through the test chamber
- various methods for cable mounting (incl. out of line with the standard)

Flame testing to B2ca, very tough!

EN13501-6 classifications standard - important definitions

3.1.7
fire scenario
detailed description of conditions, including environmental, of one or more stages from before ignition to
after completion of combustion at a specific location or in a real scale simulation (EN ISO 13943)

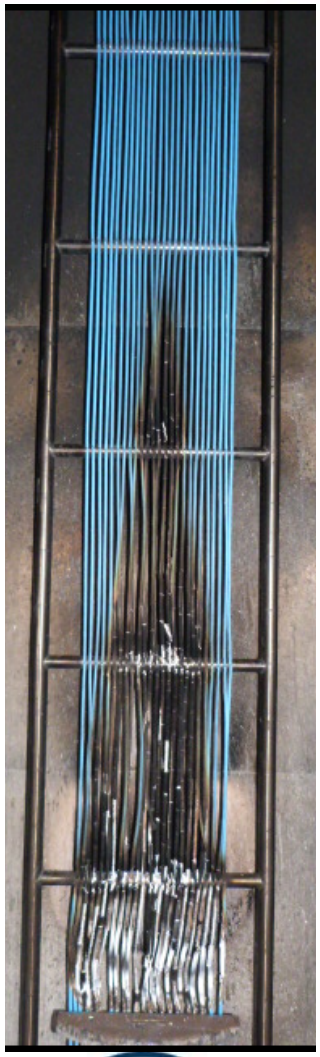
3.1.8
reference scenario
hazard situation used as a reference for a given test method or classification system

3.1.15
heat release
calorific energy which is released by the combustion of an item under specified conditions
(EN ISO 13943) – *note Total Heat Release THR and Peak Heat release rate HRR*

3.1.17
vertical flame spread (FS)
damaged length of the sample, as measured in the EN 50399 test

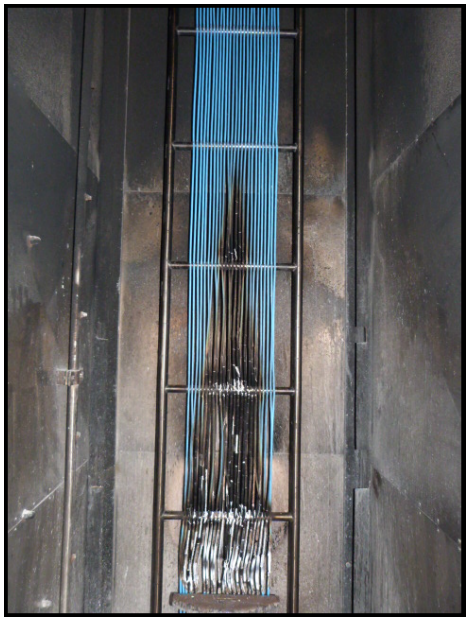
3.1.22
flaming droplets/particles
material separating from the specimen during the fire test and continuing to flame for a minimum period
as described by the test method

3.1.23
FIGRA
fire growth rate index used for classification purposes for the classes B1ca, B2ca, Cca and Dca
for the classification of cables, FIGRA means the maximum of the quotient of heat release rate from the specimen, excluding the contribution of ignition source, and the time of its occurrence using a THR threshold of 0,4 MJ and an HRR threshold of 3 kW.

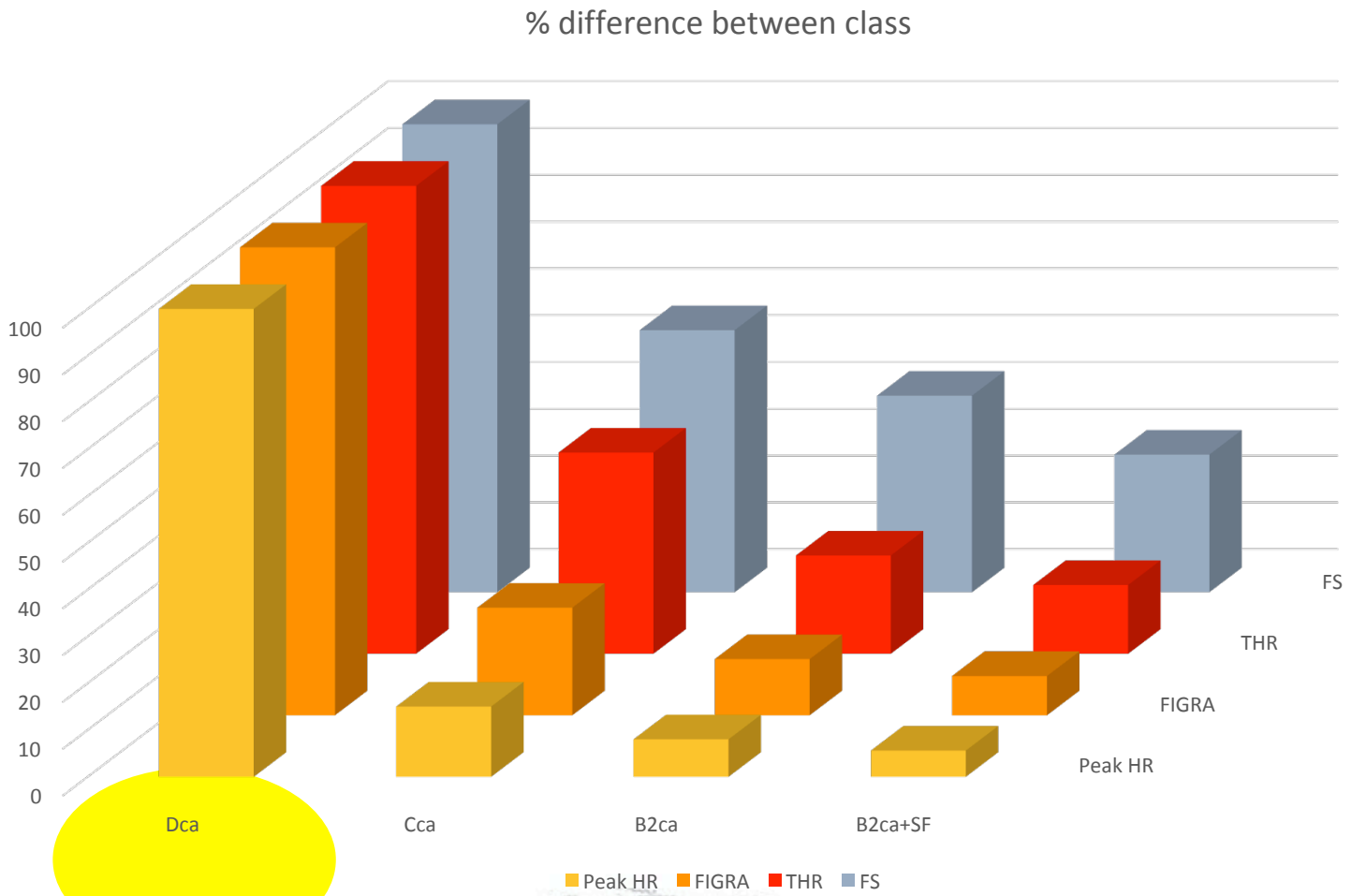


Flame testing to B2ca, very tough!

- **a) EN 60332-1-2**
- Under conditions of surface flame attack, and with an exposure time in accordance with table 1
- of EN 60332-1-2, there shall be no flame spread (H) in excess of 425 mm before the test flame extinguishes.
- **b) EN 50399 with 20,5 kW flame source**
- FS ≤ 1,5 m
- THR1200s ≤ 15 MJ
- Peak HRR ≤ 30 kW
- FIGR*A* ≤ 150 Ws-1



Flame spread – What's the difference?



Flame Spread real scenario…

- New Hospital is fitted with 1,500,000m of data cable (not uncommon!)
- The project called for B2ca, for very good reasons (throughout the EU demands are for higher classes)…small flame spread, small heat release, self distinguishing *
- Installation methods (see EN50174-2) and guidance for comms cable (TR62222) would ensure that in the event of a fire, safety would come first.
- **If** all the cable installed at the hospital was B2ca and a fire started (at every comms room at the same time!), the total heat release it would contribute to a fire would be approximately 11,719MJ (megajoules).
- The if is of course apocryphal as there would have to be many fires starting all at once….

* The building is “B2ca” all emergency services (fireman) aware…

What If the class was incorrect? - Flame Spread real scenario…

- New Hospital is fitted with 1,500,000m of data cable (not uncommon!)
- The project called for B2ca, for very good reasons…cable was found, through market surveillance, to be **Dca**
- **If** all the cable installed at the hospital is now Dca, by mistake, the total heat release it would contribute to a fire would be up to 900,000MJ (B2ca 11,719MJ) an increase of >7,000%
- This is real… as Dca does not self extinguish and the flame would spread up/down/left and right…
- That's why it is so important to get the flame testing right
- Some products are more susceptible than others, behaving differently due to minor changes in process/material/design – for example the most popular product in the world, Cat 6 UUTP…and many indoor OFC…

New test rig in Prysmian…note the full height of the chamber

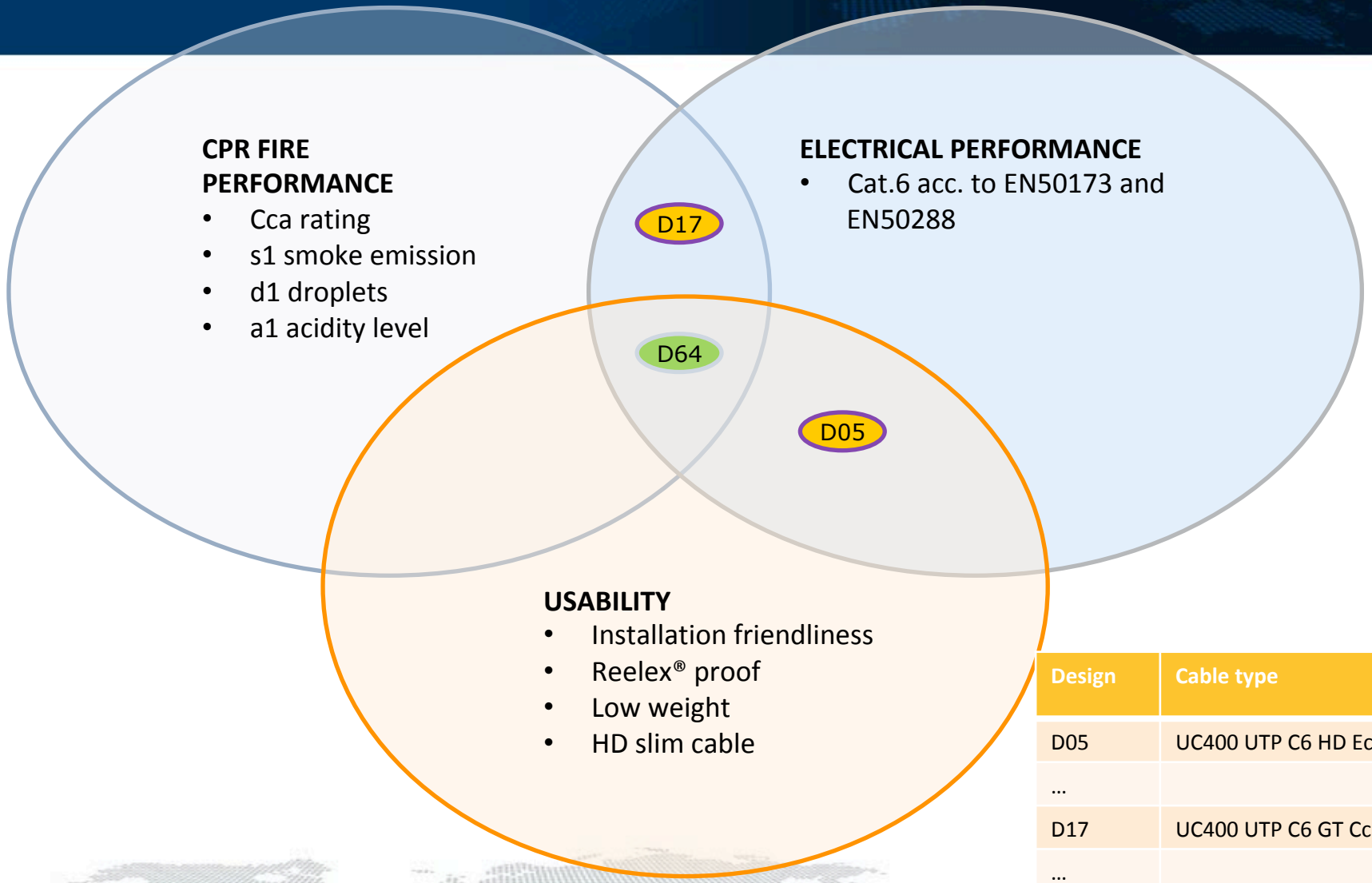
A Dca failure…cable marked as B2ca
7 minutes after ignition, 4m high, flames

Another failure – identical product – both claiming the same flame spread…

A case study – Cat 6 D64 U/UTP…

- Here follows a study in design issues taking 18 months and 64 designs… that's 63 fails, OVER 180 TESTS!
- Fortunately Prysmian Group has many fully integrated flame test rigs that are constantly checked for reliability and quality.
- However, the story never ends as the final design still had to pass the ultimate test, reelex packaging!
- We all already know the damage reelexing causes to the product electrically, what was not so well known was the affect on flame testing.
- It is clear now that the first 100m out of a box is a class below (Cca > Dca) the last 100m!
- All our test results were checked a minimum of 3 times: final product is tested more than 10 times to ensure reliability (using 3 different test rigs/ NB's)…

The issues faced with every design…



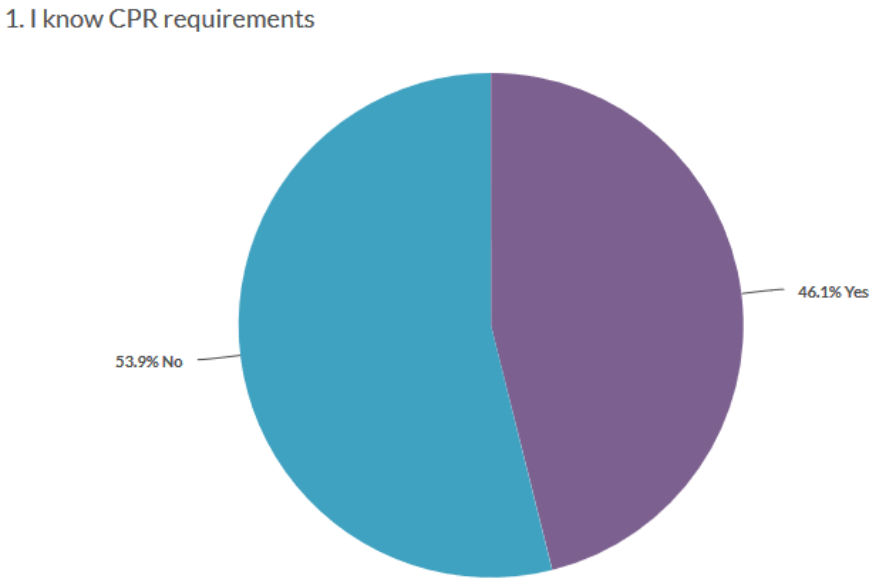
Design	Cable type
D05	UC400 UTP C6 HD Eca
…	
D17	UC400 UTP C6 GT Cca
…	
D64	UC400 UTP C6 D64 Cca

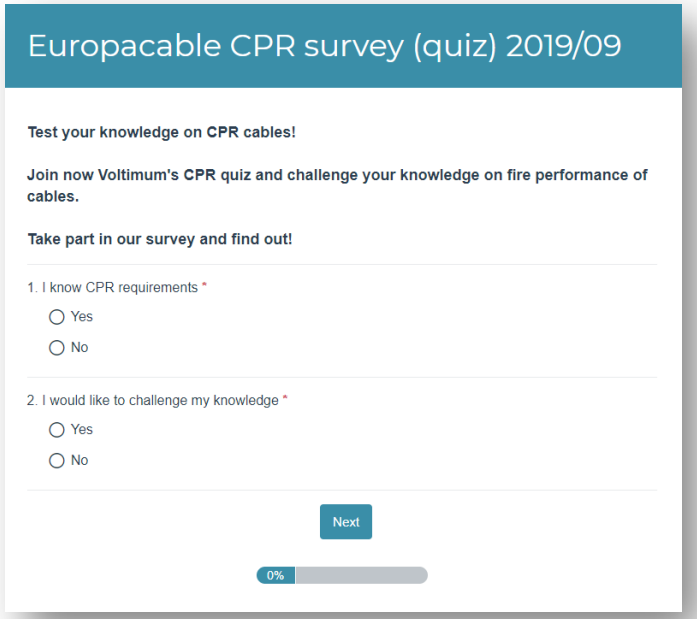
D64 – these design issues could also be the same for every small indoor OFC…

- **So the design now is:**
  - **Copper conductor – non flammable**
  - **PE insulation – flammable (*same for OFC)***
  - **air pockets, but just enough (*same for OFC)***
  - **Specialist Cross spline separator –Ethylene Vinylacetate copolymer – semi-flammable**
  - **air – just enough…(*same for OFC)***
  - **Specially processed Thinner Outer Jacket - Ethylene Vinylacetate copolymer – semi-flammable (*same for OFC)***

Passes!! – <u>commercially viable</u>

CPR Knowledge assessment through SURVEY





Value	Percent	Responses
Yes	46.1%	682
No	53.9%	798
	Totals: 1,480	

- **46%** of respondents say that they know about CPR requirements (vs **44%** in the previous survey)
- The survey was executed in 6 European Markets (Sweden, Spain, Italy, France, UK and Germany). In total 1442 electrical professionals were part of the survey

Summary

- 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 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.
- Constancy of Performance (CoP) means exactly that…the owner of the product constantly checks performance-process-materials and does NOT change design!
- Remember, the Director who has signed the Declaration of Performance (based on a CoP) is stating that the same product, now found on the market, meets the classification; but, was this checked?

Thank You for Your Attention !

Questions ?

END