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BRE Global editorial for Wiring Matters – for publication with link to full study report supplied as PDF.

Fire performance of cable installations: new study published

Research commissioned by the Department for Communities and Local Government (DCLG) has thrown new light on the fire performance of electrical cable supports and fixings. The findings are significant in terms of fire safety aspects related to the installation of cables in buildings.

Ciara Holland of BRE Global highlights the key findings.

Falling cables in burning buildings have been associated with a number of fatalities during fire-fighting and rescue over recent years.

Several recommendations have been made to the UK Government as a result of HM coroner inquests into incidents where fire-fighters were trapped by falling cables. These have included:

- Following an inquest in 2007, a recommendation was made to social housing providers that the support of fire alarm cables should conform (as a minimum) to BS 5839 – Part 1: 2002; clause 26.2 (f:).

- Following an inquest in 2013, the coroner recommended an amendment to BS 7671 (2008) to ensure 'all [sic] cables, not just fire alarm cables, are supported by fire-resistant cable supports'.

- In the wake of a warehouse fire which claimed the lives of four fire-fighters, Warwickshire Fire and Rescue Service issued an Operational Bulletin in March 2012 (OB 12/04) regarding "Hanging Cable Hazards from Surface Mounted Conduit and Trunking". This was based on experimental work by BRE Global for the Fire Service confirming that plastic conduit or trunking surface mounted on ceilings and walls may fail at relatively low temperatures (150°C).

The aim of the new study was to assess the ability of a selection of commercially available cable supports for electrical installations to maintain their integrity and hold cabling in place when exposed to temperatures typically encountered in compartment fires. Bench-scale experiments were also carried out to assess the performance of a range of commercial fixings for cable supports in concrete substrates when exposed to elevated temperatures.

The work is not intended as a comprehensive experimental programme of individual products, but rather as a 'proof of concept' and to demonstrate a possible simple solution to the issues raised.

Cable support experiments

The cable supports were assessed using an experimental rig at BRE's fire research facility in Watford incorporating the ISO 9705 fire test room (ISO room) of dimensions 3.6 m x 2.4 m x 2.4 m. This was connected to a timber-frame and plasterboard (single layer 12.5 mm Type F) lined corridor measuring 3.5 m x 1.5 m x 2.4 m. The walls, floor and ceiling of the ISO room were lined with two layers of 12.5 mm Type F plasterboard.

Four sets of five cables, supported with a selection of cable supports, were installed horizontally across the width of the corridor. These were fixed to alternating timber sleepers and concrete lintels measuring approximately 220 mm wide – spaced along the corridor at approximately one metre apart.

Standard 1.5mm flat twin and earth PVC sheathed cable was used for all experiments.

Five types of cable support, one plastic and four metal, were used to represent commercially available 'fit for purpose' products. The cable supports were fitted approximately 300 mm apart along the cable length with five supports of each type per lintel.

The four metal supports were fixed to the timber lintels using zinc-plated hardened steel 7 x 1¼ inch twinthread wood screws which were screwed directly into the timber. The fifth, a plastic clip, was fixed using its own pin. The same fixings were used for all the supports, in the concrete lintels, including the plastic clip, but with the screws fixed into standard plastic wall plugs.

Two experiments (1 and 2) were carried out involving different severities of fire.

- In experiment 1, the recorded temperature in the ISO room at ceiling height was 397°C. The maximum recorded temperature at ceiling height, approximately 1.8 metres from the ISO room (excluding lintels), was 302°C.
- For the second and more severe fire (experiment 2), the maximum recorded temperature in the ISO room 0.5 metres from the ceiling was 820°C. The maximum recorded temperature at the ceiling in the corridor, approximately 1.8 metres from the ISO room (excluding lintels), was 690°C.

Bench-scale experiments on fixings

A series of bench-scale experiments was carried out using a range of commercially available fixings for cable supports, including plastic plugs and self-tapping screw, installed into standard aerated concrete blocks. Each block was exposed to one set temperature - from the range 100°C, 200°C, 300°C and 400°C - for one hour.

Key findings

It is important to note that this was a simple scoping study only a small selection of cable supports made of plastic and metal. Further work would be required to assess the effect of fire on cable supports composed of other materials.

In the cable support experiments, the plastic clips failed when exposed to hot gases as low as 204°C. The four different metal supports remained intact after being subjected to hot gases and flames from the experimental fires and would themselves have prevented the cables from dropping down.

The temperatures at which cables dropped due to failure of cable supports or fixings covered a wide range, from 212°C to 486°C. Any dropping of cable with metal supports was a result of fixing (plastic plug) failure.

The findings from the bench-scale fixings study showed that combustible wall plugs in concrete substrates demonstrate signs of weakening of mechanical strength from 300°C and above. Additionally, these fixings can fail at 400°C after up to a one hour exposure in controlled conditions.

Non-combustible wall anchors and concrete screws were capable of retaining mechanical strength after exposure to 400°C for one hour in the same controlled conditions. This allows the conclusion that there are commercially available products which can maintain their mechanical strength at that temperature.

Other results show that cabling does not necessarily have to be contained in non-combustible cable management systems, see full report for further details.

In conclusion:

• To prevent the risk of failure of cable supports during an incident, cable supports capable of maintaining their mechanical strength when exposed to temperatures greater than 600°C should be used.

• The programme of work also demonstrated that there are commercially-available fixings capable of withstanding up to 400°C.

• This series of experiments has shown that quite simple and readily available supports and fixings which are capable of withstanding temperatures greater than 600°C can be sufficient to avoid cables falling when exposed to typical compartment fires.

ENDS

A full report on the experiments, components evaluated and findings, authored by Ciara Holland, Martin Shipp and David Crowder of BRE Global, is available free on the IET website at: [xxxxxxxxxx]. (Also here www.bre.co.uk)

Images (3 no.)

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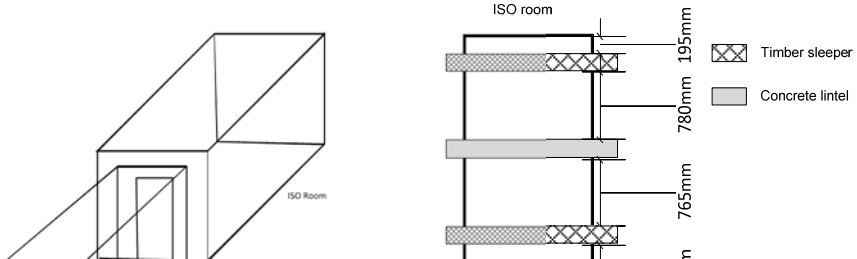
Cable supports capable of maintaining their mechanical strength when exposed to fire event temperatures greater than 600°C should be used to prevent the risk of failure.



(Img file ref WM3...)
The temperatures at which cables dropped due to failure of cable supports or fixings ranged from 212°C to 486°C, with plastic clips/plastic wall plugs being the contributing factor.