HCS White Paper

Fire safety standards for LAN cabling systems

WP010112

Executive Summary

Safety of people is compromised when inadequate fire standards are specified for LAN cabling systems. Most installations of LAN cables are done in bundles while the flame test specified in most cases is for single cables only.
Most cables presently installed are complaint only with IEC 60332-1, which is not an adequate flame-test for cable bundles – only for a single cable.
A cable selected for installation in bundles in large sites must be LS0H and complaint with the relevant sections of IEC 60332-3 otherwise the safety of the people is compromised.
HCS, as well as other high quality brands, has CAT 6 (shielded and unshielded), CAT 6A, CAT 7 & CAT7A ETL Verified LS0H horizontal cables which fully conform to IEC 60332-3-24 & 25.
To maximize the level of safety all LAN cables must be LS0H and must meet IEC 60332-3, not IEC 60332-1.

Cable burning issues

The role of cables in fire safety is complex.
The relative qty of cables in any building is usually small, but they have some distinct features which affect their ability to cause and sustain fire:

- They usually contain organic combustible materials.
- They are usually routed throughout the building and may convey the flames from one point to another.
- They may be installed in vertical shafts, which may act as air-pumps (chimney effect) in case of fire.
- They may ignite in case of short circuit.
- They may release toxic & corrosive fumes when burning.

The required level of flame retardancy is based on the way the cables are installed and is verified by different flame-tests. Different standards have different test methods but the most widely used in Europe are the IEC and CENELEC standards:

IEC	CENELEC EN	Test Method
60332-1	50265-2-1	Vertical sample Single cable Single 1 kW Flame 1-8 minutes
60332-3-21	50266-2-1	Vertical ladder >35 mm2 Cond. 7 Liter CM/m cable Ribbon Burner 40 minutes
60332-3-22	50266-2-2	Vertical ladder <35 mm2 Cond. 7 Liter CM/m cable Ribbon Burner 40 minutes
60332-3-23	50266-2-3	Vertical ladder 3.5 Liter CM/m cable Ribbon Burner 40 minutes
60332-3-24	50266-2-4	Vertical ladder 1.5 Liter CM/m cable Ribbon Burner 20 minutes
60332-3-25	50266-2-5	Vertical ladder 0.5 Liter CM/m cable Ribbon Burner 20 minutes

IEC 60332-1 vs IEC 60332-3

IEC 60332-1 is used for testing single cables which are installed alone (e.g. one cable in a tray or on a ladder):
Obviously, this test is not suitable for real-life cabling systems.

IEC 60332-3 is the test method that properly simulates cables installed in real-life sites, where tenth or even hundreds of cables are packed together.
IEC 60332-3 is conducted in a 4-meter high chamber and the burners flame is boosted by 5000 liter air per minute. This test imitates the conditions where large bundles of cables are burning.

As shown, IEC 60332-1 cannot predict the burning behavior of LAN cables in real cabling systems – and it is not designed for it.
IEC 60332-3 is specifically designed for this purpose, yet over 95% of the LAN cables installed do not conform to it, as the cables are merely conforming to IEC 60332-1 (or UL VW-1, which is the UL equivalent).

This means that most cables installed in bundles and in large sites are a "ticking bomb", waiting to explode.

How did we get there?

LAN cables that comply with IEC 60332-3 are more expensive than cables complying only with IEC 60332-1 so in some cases the cheaper cables are specified because of the price difference – but the sad truth is that in most cases it is done because the consultants and the network designers don't know the difference.

The purpose of this white paper is to draw the attention of all consultants to this incredible negligence so they start specifying the correct cables for the cabling systems they design.

Halogen-Free or not?

Fires pose a real safety threat but actually the smoke generated by these fires causes much more damage in both human lives and property.

Basic facts:

- The most common cause of death in fires is the inhalation of noxious gases rather than thermal injury.
- PVC, which is still the most widely used cable jacketing material, releases HCl and CO during fire. Standard PVC compounds release also black and dense smoke.
- HCl becomes hydrochloric acid when mixed with water (in the air and in the human body).
- HCl is a toxic colorless & odorless gas, having a lethal dosage of 500ppm in air.
- HCl is highly corrosive, causing substantial damage to electronic & office equipment in very low concentrations.
- CO has a choking effect (preventing the lungs from getting O_2).
  Its lethal dosage is 4000ppm in air.
- Heavy smoke causes loss of direction, minimizing chances to escape.

Example: The MGM Grand Hotel fire
The MGM Grand Hotel fire occurred on November 21, 1980 in Las Vegas, Nevada, USA. Smoke and fire spread through the building, killing 84 people and injuring 650, including guests, employees and 14 firefighters. While the fire primarily damaged the second floor casino and adjacent restaurants, most of the deaths were on the upper floors of the hotel, and were caused by smoke inhalation. Openings in vertical shafts (elevators and stairwells) and seismic joints allowed toxic smoke to spread to the top floor. The disaster led to the general publicizing of the fact that during a building fire, smoke inhalation is a more serious threat than flames.
75 people died from smoke inhalation and carbon monoxide poisoning, 4 from smoke inhalation alone, 3 from burns and smoke inhalation, **only one person died from burns alone.**

HCl Corrosivity

HCl, released from PVC jacketed cables, is not only a killer – it also has a serious power of destruction. There are hundreds of recorded events, where short circuit caused overheating of PVC jacketed cables which lead to release of HCl without causing a visible flame. The gas released may easily corrode control cabinets, relays, connectors, computers and any other sensitive factory machines and office equipment.
PVC jacketed cables are banned from ships, aircrafts, submarines, and any other sensitive enclosed systems, even in the unmanned areas.

The LS0H debate: USA vs Europe

In recent years most European countries have adopted the LS0H concept, and in most large projects LS0H cabling is specified.
In the USA, where cabling are defined by the National Electric Code (NEC), PVC and/or FEP jacketed cables are used in plenum spaces above ceilings and below floors in office buildings. Some organization that are exempt from local building code – like the military and mass transit authorities – have banned halogen from their networks.
Building plenums and spaces are typically used to circulate air throughout the workplace. In case of fire the air conditioning ducts could become conduits for hydrogen chloride, hydrogen fluoride, and the other gasses that cause far more fatalities than flames or visible smoke.
It is high time that all large projects in Turkey will be required by law to use 100% halogen-free cabling. This should include schools, universities, hospitals, airports, high-rise buildings, government building and any other places where people safety is a priority.

HCS LS0H LAN Cables

As opposed to many other manufacturers, HCS has the testing facilities needed to perform IEC 60332-3 flame tests, smoke density, acid gas and halogen content.
All HCS cables are tested periodically & formal test reports are issued, ensuring & documenting their standard conformity and safety.
HCS LS0H LAN cables are available with 3 optional flame test conformance:
IEC 60332-1, IEC 60332-3-24 and IEC 60332-3-25.
The flame test & safety level of HCS LAN cables is specified in their P/N, minimizing the chance to confuse cable types.

Category 6 U/UTP LS0H IEC 60332-3
Foil shielded & PVC jacketed cables are better protected against flame propagation as the aluminum foil blocks the flame to a certain degree and as PVC is inherently flame-retardant.
Category 6 LS0H U/UTP cable contains a relatively large amount of combustible material and has no metal barrier to protect the inner core.
Producing a Category 6 U/UTP LS0H cable that conforms to the harsh requirements of IEC 60332-3 is an important achievement of HCS R&D Team and good news for our customers using unshielded cabling systems.

HCS Smoke density & Acid-gas content testing

In addition to the extensive flame tests, the amount of smoke and toxic fumes must be maintained within the standard limits. Cables are produced from several different components & materials which must not release toxic fumes when burned.
Most LS0H cable manufacturer rely on the raw material suppliers and do not have the facilities needed to test the real performance of their cables.

HCS is fully equipped with all test equipment needed to perform all the tests required by the standards.



.

HCS test equipment for smoke density & Acid-gas

HCS is fully equipped to perform the following tests on regular basis, ensuring the safety performance of its LAN cables:

- ✓ IEC 60754-1: Tests on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas.
- ✓ IEC 60754-2: Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity.
- ✓ IEC 61034: Measurement of smoke density of cables burning under defined conditions.

Summary

- LAN cables may become a safety hazard when installed in large bundles.
- Most cables presently installed are complaint only with IEC 60332-1, which is not an adequate flame-test for cable bundles – only for a single cable.
- Cables selected for installation in bundles in large sites must be LS0H and complaint with the relevant section of IEC 60332-3.
- HCS has CAT 6 (shielded and unshielded), CAT 6A, CAT 7 & CAT7A ETL Verified LS0H horizontal cables which fully conform to IEC 60332-3-24 & 25.

HCS – HES Cabling Systems

HQ: Turgut Reis Mah.Barbaros Cad. Giyimkent Kooperatif içi Vadi Bulvarı No:1
34235 Esenler, İstanbul, Turkey.
Phone: +90.212.438.25.75 (pbx) Fax: +90.212.438.25.74.

PLANT: Erciyes Mahallesi Hes Caddesi No:22 38210 Kayseri, Turkey
Phone: +90-352-442 25 40 Fax: +90-352-442 28 00