White Paper on the topic of "Visual Alarms in accordance with EN 54-23"

Acoustic signal devices have long been a fixed component of fire alarms and other security systems and are considered extremely mature technology for these applications.

The underlying function of these acoustic devices has remained almost unchanged for many years. The effectiveness of the alarm function on devices of this kind in fact relies on more than just signal devices. The human element is another decisive factor here as well — people must not just perceive the signal, but also be moved to act on that signal.
In the age of constantly growing environmental influences, the exclusive use of special acoustic alarms in dangerous situations must be considered anew and assessed given the modified environmental conditions. Beyond requirements for hearing protection at the workplace, other acoustic "disruptions" have long since become a standard part of daily life; this makes it extremely difficult for people to immediately identify whether a given signal falls into the range of "information" or "alarm". A variety of technological sounds, ranging from confirmation signals on machines to the use of portable music players, means that acoustic alarm signals are either not perceived or are simply classified as non-essential. One real life example would be a blaring car alarm.

Yet it's more than just the constantly growing acoustic "smog" that has made it increasingly difficult to perceive and properly classify alarm signals: According to a study by the World Health Organization from 2005, some 278 million humans worldwide are suffering from hearing damage that ranges from slight to extreme. For these people a purely acoustic alarm will not ever be effective.

For this reason fire alarm systems are increasingly using visual signalling devices as a supplement to the acoustic signals. A visual/acoustic alarm combination is for example always required where the so-called ambient noise level is already very high and could potentially disrupt the perception of the acoustic signal.

While NFPA 72 has long established a regulatory framework for this issue on the American market, there was no comparable European technical legislation for visual signalling effectiveness. The flash energy of a XENON flashing light (measured in Joules) is often used here as a selection criterion for the deployment of the lamps. Yet from a strictly technical point of view, flash energy has no relation to the emitted light intensity (measured in candela [cd]), and thus to range or perceptibility. This leads not just to confusion by the contractors who install the equipment, but also to a situation where many installed optical systems are designed at insufficient performance levels due to the uncertainty.

The growing need for visual alarm devices is one important reason why the technical standard EN 54-23 (Fire detection and fire alarm systems – Part 23: Fire alarm devices - Visual alarm devices) was developed in the EU. It defines the fundamental requirements for visual alarm devices and provides a comparison of different light sources, such as XENON and LED. It defines the performance benchmarks that devices must achieve for specific applications in the fire detection and fire alarm fields.

EN 54-23, which goes into mandatory effect in early March 2013, was developed as a supplement to EN54-3 for acoustic alarm devices; the coexistence period already ended in 2005, meaning that it is now the state of technology.

Unlike EN 54-3, EN 54-23 presents direct information on the planning and application of visual alarm systems. For example the standard defines the luminous emittance [lx] that the alarm equipment must generate at all positions within the signal reception range. The devices are further classified into three categories, depending on the intended usage. For categories "W" (Wall) and "C" (Ceiling) the geometry of the signal reception range is already prescribed. Category "O" (open) leaves open the shape of the room, allowing the manufacturer to design the signal range freely; in this case the property of the alarm system must be described in detail and designed and crafted for optimal application.

In terms of geometry, the "W" category calls for a cube-shaped signalling range covering a defined W-x-y area:

– x reflects the maximum mounting height of the alarm system in metres (m) on the wall with a minimum value of 2.4 m; and

– y defines the width in metres (m) of the square room to be illuminated by the alarm system.

"W-2.4-6" thus stands for a wall-mounted alarm system that achieves a cubic signalling range of 2.4 x 6 x 6 m, mounted at a height of 2.4 m.

Alarm systems in category "C" are specified with the descriptor C-x-y, whereby:

– x is either 3, 6 or 9 and depicts the maximum height in metres (m) at which the alarm system may be mounted; and

– y is the provided diameter of the cylindrical signalling range in metres (m) when the alarm system is mounted at the defined ceiling height.

"C-3-12" thus stands for a ceiling-mounted signalling device with a cylindrical signalling area of 12 m in diameter and a mounting height of 3 m.

These predefined signalling ranges and the minimum illumination strength of 0.4 lux as defined in EN 54-23 mean that future devices that consume less power and offer only a lower light intensity will only be suitable for very small spaces, such as washrooms and toilets. Here the use of LED or XENON technology is of little importance. An energy consumption comparison for these two technologies shows that the LED does not fare better. The effective power consumption of a Xenon flashing light is lower than for an LED flashing light, which offers almost the same effective light intensity as the Xenon lamp. LED lamps are furthermore considerably more expensive than comparable Xenon lamps.

For larger surfaces and spaces it therefore follows that devices are required that offer a significantly higher lighting intensity than in the past. The lack of technical standards had frequently led to a situation where power consumption was used as a deciding criterion for a visual signalling device, since this has a major impact on the emergency power supply.

Without doubt the new standards will impact the development of a new generation of visual signalling devices for use in the field of fire detection and fire alarm technology.

As already mentioned above, visual fire alarms will for the foreseeable future serve solely as a supplement to acoustic alarms, which makes the combination of the two alarm types in one case sensible and efficient. Combination devices of this type must be permitted both based on EN 54-3 and EN 54-23, meaning that the signalling range for the combination is restricted to the signal type that covers the smaller area. In terms of optimal harmonisation of these two technologies, it makes sense for the signal range to be identical for both technologies.

If one examines the signal reception distance for sounders, the safe alarm range for a 100 dB(A) sounder in an environment with 70 dB(A) of ambient sound is 10 m; for a 120 dB(A) sounder with 82 dB of ambient noise, that distance is 25 m. This observation, which is frequently used in actual application, makes it clear that the variable light intensity plays a major role in terms of the effectiveness of combination devices. If a 120 dB(A) sounder under the same conditions is combined with a 5 Joule / 44 cd flashing light, the signal reception range for the combo-device would be limited to the lower range of the flashing light — 10 m — even though the sounder itself is suitable for 25 m. This leads not just to higher procurement and planning costs, but also raises concerns about the amount of emergency power consumed by the increased number of devices required in this scenario.
Pfannenberg, as the inventors of the flashing light in 1962, took up the issue of visual alarms in accordance with EN 54-23 at an early stage and reacted to these requirements. Beyond separate flashing lights, combination devices in the new PATROL series are being offered with a precisely harmonised signalling range. While the standard combo-devices on the market are equipped with flashing lights below 5 Joules regardless of the ambient noise level, the PATROL series offers the opportunity to vary between 5 and 15 Joules to produce the necessary flash energy for the actual ambient noise levels in the signalling range. This ensures that the application is tailored for the real exterior conditions. Light intensities ranging from 44 to 190 cd are available, corresponding to an alarm distance of approx. 10 to 25 m. The devices in the PATROL series can be delivered to accommodate ambient noise levels from 100 to 120 dB(A).

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