Reliable planning in audible fire alerting

Audible alerting in compliance with the European standard EN 54-3

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SHARING COMPETENCE

Pfannenberg
ELECTRO-TECHNOLOGY FOR INDUSTRY

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1 Editorial

Dear Readers,

The topic of alerting people has gained increased significance over recent years. One of the main reasons is an increase of ambient noise due to alarm flood or “acoustical smog” - today everything bleeps. The use of media players, hearing protection and the support of disabilities requires alerting in two senses: sight and sound. First step was the introduction of EU standard EN54-23 for visual alerting. This has been in effect since January 1, 2014. EN 54-23 requires the planning of the visual alarm to include the signalling range. This should also be done for sound – the audible alarm device. Hence developing an appropriate alerting concept is gaining increasing significance and demand.

A signalling device’s angle of radiation characteristic must be a key part of planning and developing a concept for a project. This key information is sometimes missing from datasheets and results in a system unable to meet the demands of the governing standard resulting in the actual cost exceeded the planned budget.

Fire alarm system providers, installation companies and planners can rely on Pfannenberg to provide complete information to provide protection for man, machine, and the environment.

I trust you enjoy reading this article as we Share our Competence.

Mark Egbers
Industry Group Manager Infrastructure

2 Lifesaving audible signals

Audible signaling devices have always been an integral part of fire alerting and other security systems. This is a firmly established application. The objective is to evacuate people in the affected area of the building as quickly as possible after discovering a dangerous situation.

Audible alarm devices are traditionally deployed in areas with high ambient noise. In the majority of premises the alert sound is combined with visual alarms due to an impaired ability to hear. This is regardless of whether the reduced perception is medical or to working practice (e.g. ear protection).

Acoustic smog, or back ground noise, is continually increasing. The wearing of media players makes it more difficult to perceive an alarm signal and to identify it correctly. The wide variety of non-alarm signals also makes a clear identification of an alarm signal more difficult. In order to increase the perception of the alarm signal tone the minimum sound level difference to the ambient noise level is regulated by local standards and/or in planning guidelines. This is normally shown as a +dB value.

3 Status of standardization

The following points show requirements for planning audible signalling devices in fire detection systems.

3.1 The European product standard EN 54-3

The European standard sets requirements, testing procedures and performance features for audible alarm devices. These are designed for the purpose of sending an acoustic warning signal, induced by the fire alarm system, to people in the building or in the vicinity.

The general device requirements and specification is made regarding the range of the audible signal thus giving a certified area. Every certified tone has to be measured independently due to varying sound pressure levels.

In particular, the horizontal and vertical angle radiation characteristics of the signalling devices must be checked and defined for each individual tone giving the total volume of area to be correctly alerted. This is an essential part of the approval. It must be considered during planning phase as the number and location of devices is critical to meet the approval.

3.2 Local planning standards and guidelines

The certified range of the audible alarm device has to be used during the planning and installation phases to be in compliance with the local planning standards and guidelines. EN/NFPA or British Standard definitions give the method to produce the concept for the project, the project plan. The documentation requirements and the system-specific requirements, e.g. EN 54-13, are also defined.

Local Planning guidelines set the following requirements for the audible signal:

a. Audible alarm devices must always be louder than the ambient (general) noise level by a specific value, usually between 5dB and 15dB,
b. The signal of the audible alarm devices must give the appropriate emergency signal. E.g. a certified EN-tone to meet EN54-3 or a different audible signal for a different country's guideline. However all audible alarm devices in a building should give the same sound. This precludes the mixing of bells and electronic audible alarm devices.
c. For areas where people are sleeping audible alarm devices should produce a minimum 75dB(A) at the bed-head with all doors closed.

Examples for local planning guidelines/standards are:

- DIN VDE 0833-2 (Germany) - Alarm systems for fire, intrusion and hold up, part 2: Requirements for fire alarm systems
- BS 5839-1:2013 (UK) - Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises
- TRVB 123 (Austria) - FIRE DETECTION SYSTEMS
- NFPA72 (US) - National Fire Alarm and Signaling Code

3.3 EN-tones and other specifications

The EN-certified tones are set for most of the European countries. Some of them are shown in the fig. 1. For all those tones the radiation diagram should be used as described in chapter 4.

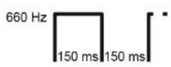
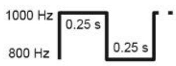
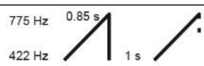
Description	
Silence	
Saw tooth, Germany DIN 33404-3 (emergency signal), PFEER PAPA	
Slow whoop, evacuation, Netherlands NEN 2575	
Continuous	
Intermittent, Sweden SS031711 (imminent danger)	
Alternating, UK BS5839-1 (fire alarm, level crossing)	
Alternating, France NFS 32-001 (fire alarm)	
Slow whoop NFPA	

Figure 1: Overview of the EN-tones and other specifications

4 Planning of audible signaling devices

Today the planning of audible signalling devices in a fire alarm system often occurs on the basis of simple data sheets from the manufacturer and/or empirical values. It is usually presumed that an audible alarm device is a “spherical emitter”, describing that the sound distribution occurs almost spherically from the source of the sound at the same intensity. This is not the complete answer for the solution.

In exceptional cases on-site tests are conducted in advance and based on the measured results standardized planning can take place. However such tests can incur significant costs or are not practical as the building could be under development and incomplete.

In order to provide planning security to the acoustic alert level further technical characteristics of the audible alarm devices must be considered:

a. The sound-pressure level [SPL] and the loudness (dB) of an audible alarm device is not identical for every tone. For planning requirements the SPL of the tone to be used on site always has to be taken as the basis for the plan. Never the loudest one available from the device.
b. The audible alarm device achieves varying dB depending on the radiation angle from the device. The maximum dB is at a 90° angle (head on) in most cases. The level is significantly reduced at the sides (0° / 180°) (see fig. 2: Radiation pattern/Polar diagram)

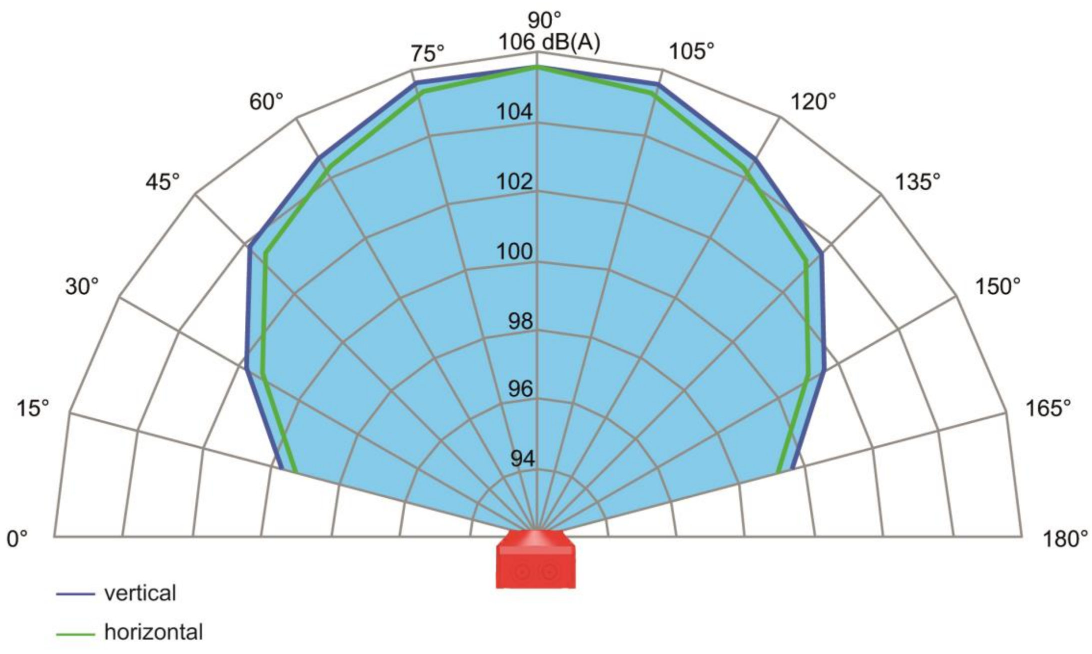


Figure 2: Radiation diagram / Polar diagram of a typical audible alarm device in horizontal and vertical levels

The exact sound-pressure levels (dB) and radiation characteristics are determined during the device’s approval process. These are obtained from the manufacturer and care must be taken that the required tone (e.g. Germany uses a DIN-tone) is certified for the device otherwise it is illegal to use it for the project. This principle is applicable for other countries and regions (see tone overview in 3.3)

Specifically in the planning phase the respective signalling range of a device must be determined. This results from the existing ambient sound level, or background noise, at the project site in connection with the radiation characteristics. (Fig. 3 – typical coverage of an audible alarm device) These are sometimes registered for every zone as a Noise Register.

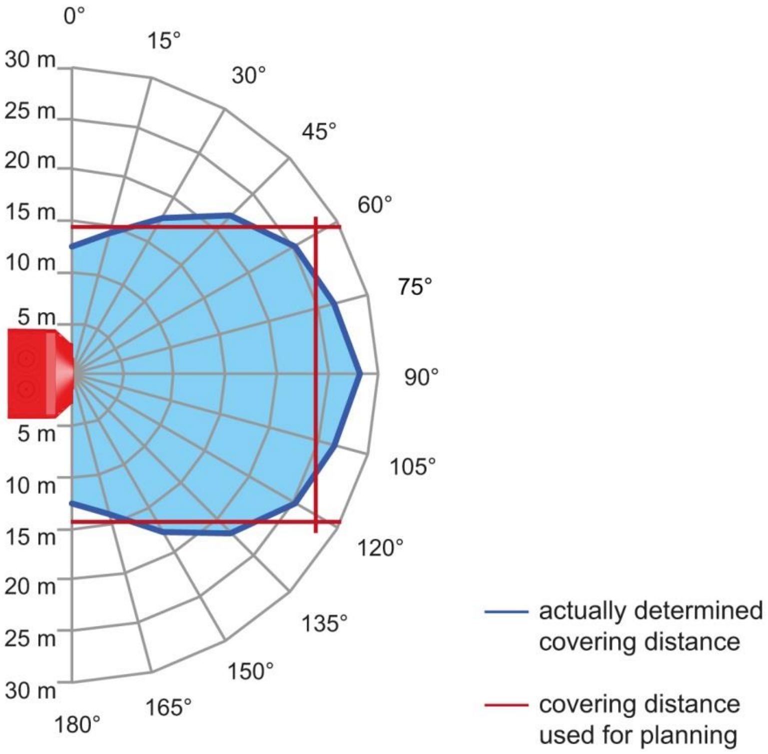


Figure 3: Typical coverage of an audible alarm device with DIN-tone, taking ambient conditions into account

The radiation characteristic of a well-designed audible alarm device will have minimised the SPL loss to < 6dB at an angle of 0° and 180° however there are products on the market with a reduction of up to 12dB. A difference that leads to a reduction of the certified signalling distance by 50% which in turn leads to double the amount of audible alarm devices that are necessary to meet the requirements for the same area.

Planning using simple data sheets and/or empirical values only, often leads to too few audible alarm devices due to weak performance. An example: some audible alarm devices are classified with 103dB(A), yet under the actual angle measurements according to EN 54-3 the true value is merely 91dB. If these two values are compared during project planning and the sound radiation diagrams are taken into consideration, then approximately four times as many audible alarm devices would have to be planned to ensure there are no 'blind spots'. The resulting fire alarm system would not be approved and more crucially the building can't be put into operation. Consequently if the planning ignores the complete radiation performance characteristic either additional audible alarm devices or higher performance audible alarm devices must be installed to meet the regulation. This will have further consequence on other requirements such as additional power supplies.

In audible signaling systems, the technology used to create the sound also has to be checked and taken into account. In fire alerting audible alarm devices based on the Piezo-electric effect are often used due to the low power consumption. Looking at the performance capacity of these devices an electromagnetic sound generation unit provides a much larger coverage than Piezo technology. If you overlaid the achieved coverage in relation to the power consumption of the device it is clearly seen that the efficiency factor of the electromagnetic sound generation is considerably higher than the Piezo technology.

5 Conclusion

For the reliable and cost efficient planning of audible signaling devices, it is necessary to take the appropriate radiation characteristics into account. By taking the actual coverage of the audible alarm devices into account the best possible planning security throughout the whole project phase and compliance with standards are guaranteed. This ensures the project schedule and cost is truly considered.

The correct planning and design of the signalling ranges with viable certified data takes project specific conditions into account and the exact number of audible alarm devices required are installed. This ensures over-dimensioning is avoided and consequently reduces the total cost of the installation.

6 Company Profile

Pfannenberg is a medium-sized company that operates globally and develops and sells high quality electro-technology for industrial applications. The company manufactures components and system solutions for the business sectors thermal management and signaling technology. The product range for the business sector thermal management comprises air/water heat exchangers, air/air heat exchangers, cooling units, liquid chillers in various cooling capacities as well as fan heaters and thermostats. Thermal management solutions from Pfannenberg are used above all in industrial environments, e.g. for the cooling of electrical enclosures and machines in automobile production, the food industry, wind and solar power plants.

In the field of signaling technology Pfannenberg provides visual and audible signaling devices which conform to internationally recognized standards. These are used in building management or by machine and plant constructors to comply with fire regulations and other health and safety regulations. In both business sectors the companies provide the customers with single components and complete system solutions with individual consultations.

Pfannenberg sells its products in over 50 countries and has worldwide four production plants: in Germany, Italy, China and the USA. A comprehensive distribution network is guaranteed by its 9 subsidiaries. The company was founded in 1954 and still has its headquarters in Hamburg. It has a worldwide staff of about 400. The turnover in 2013 amounted to roughly 63 million euros.

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More information on our products: www.pfannenberg.com

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Disclaimer:
All details were carefully researched in March 2015.
We can, however, not offer any guarantees with regard to the completeness and correctness of the stated information.

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