

The background of the top half of the page is a photograph of a modern, multi-level parking garage. The floor is highly reflective, showing the overhead lights and the silhouettes of cars parked on the upper levels. The lighting is a mix of cool white and green, creating a clean, industrial atmosphere. In the top left corner, there is a white rectangular box containing the Siemens logo and tagline.

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## Fire protection in parking garages

Protection of people, business continuity  
and reputation

A fire in an enclosed garage can very quickly create a dangerous situation for all people in that area. Due to the significant fire load of the parked cars, a fire which is not detected and dealt with quickly can develop into a fire that is very difficult to extinguish and may even threaten the stability of the building.

Not only can deceptive phenomena such as exhaust emissions affect early and reliable fire detection, the harsh environmental conditions in garages can also affect the service life of ordinary fire detectors. For this reason, only fire detectors which respond robustly to such deceptive phenomena and which were developed especially for such harsh environments should be installed in parking garages.

In the event of a fire, alerting and evacuating all parties at risk in time has the highest priority. A fire protection system is needed that guarantees rapid and reliable fire detection and activates both the alarm devices and the relevant fire control installations.

Early warning of a fire is essential; not only for protecting people, but also for ensuring business continuity and the reputation of the hotel. However, unnecessary evacuation activities due to false alarms must be avoided.

# Content

Content .....	2
Introduction .....	3
Basic conditions.....	3
Solution .....	4
Practical experience .....	7
ASAtechnology .....	8
Everything you need for comprehensive fire protection .....	8
Share the experience .....	8



# Introduction

## Highlights<sup>1</sup>

- Parking garages have a low to moderate fire risk
- A fire can develop quickly into a dangerous situation due to the high fire load of the cars
- One out of every 12 hotels reports a structural fire per year

Hotel guests expect a hotel to make enough parking spaces available and to guarantee the safety of all cars and their contents. If the hotel has an enclosed garage which can only be used by hotel guests, the risk of damage or theft is significantly lower than it would be in public parking garages. However, the situation concerning fire risk is different. If a fire starts in an enclosed parking garage, the risk to people, as well as the risk that cars will be damaged, is significantly higher than it would be for an outdoor parking lot.

In order to limit fire damage in enclosed parking garages, appropriate measures are required in the areas of structural, technical and organizational fire protection.

### The following applies to all enclosed parking garages

- There must be at least two well sign-posted escape routes
- The garage must have emergency lighting
- Portable fire extinguishers must be provided
- No flammable materials such as gasoline, oil, gas bottles, chemicals, wood, cardboard boxes, etc. may be stored there

### Additionally, the following applies to large underground garages

- The garage must be separated into fire compartments
- It must be equipped with a mechanical ventilation system
- It must be equipped with a fire detection system
- It must be equipped with an automated fire extinguishing system
- It must be equipped with a CO warning system

It should be noted that country-specific regulations may vary in accordance with local codes of practice.

# Basic conditions

## Objectives

- Early alerting of all people at risk, safety officers and the fire brigade
- Preventing the fire from spreading to other hotel areas
- Preventing unnecessary alerting of guests and the fire brigade

## Typical fire hazards

- An overload or short circuit of electrical equipment (e.g. motor of a ventilation system)
- A technical fault in a vehicle
- Flammable material catching fire from flying sparks during welding work etc. or by careless handling of tobacco products

## Typical development of a fire

In a parking garage, there is no typical development of a fire – it can start with a smoldering phase or directly with an open flame.

An overload or short circuit of an electrical appliance can lead to a fire which starts with a smoldering phase and progressively generates increasing quantities of visible smoke. If such an incipient fire is detected at an early stage, it can be dealt with easily (e.g. by disconnecting the power supply).

If easily flammable material comes in contact with a powerful heat source or even an exposed flame, this can directly lead to an open fire. If such a fire is detected in time, it can often be extinguished with a hand-held fire extinguisher.

If an open fire is detected too late, it can quickly spread to several cars and can then only be extinguished by an automated fire extinguishing system or the fire brigade.

## Critical Points

- Preventing delayed fire detection – for example by fire aerosols being diluted by the airflow from the ventilation system
- Preventing false alarms due to deceptive phenomena – for example from exhaust emissions generated by a lot of traffic or cold-starting turbo diesel vehicles
- The high fire load due to parked cars
- In the event of a fire, the whole area can fill with thick smoke very quickly because of the relatively low ceiling
- Extinguishing a vehicle fire is very difficult and is possible only in a limited way with a sprinkler system

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<sup>1</sup>NFPA, U.S. Hotel and Motels Structure Fires; U.S. Fire Administration's (USFA's), Hotel and Motel Fires

## Solution

If the statutory structural and organizational measures have been complied with, there is only a low to medium fire risk in enclosed parking garages.

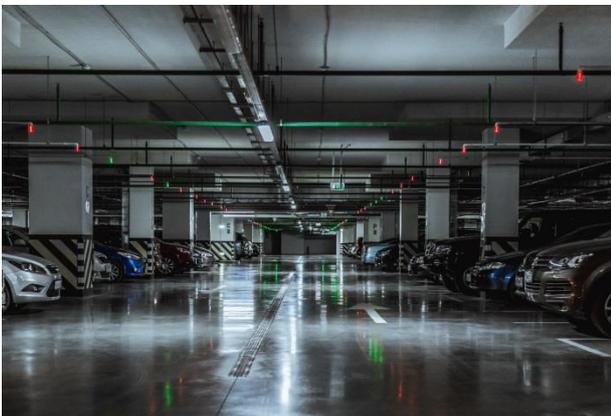
If there is a lot of traffic, or turbo diesel vehicles are cold-started, aerosols are generated which can trigger unwanted alarms in fire detectors. Additionally, parking garages can be badly affected by contamination from soot particles, rubber abrasion from the tires or melting ice containing de-icing chemicals (salt etc.).

In enclosed parking garages, automatic fire detectors must be used which can not only detect an incipient fire early and reliably but can also respond robustly to exhaust emissions. In such a harsh environment it is also important that the service life of the fire detectors is adequate.

If an autonomous CO warning system is not required, the use of fire detectors, which (in addition to smoke and temperature sensors) are also equipped with a CO sensor, is recommended. These fire detectors support ventilation control, based on the CO concentration and generate a warning when a dangerous CO concentration is reached.

In addition to the automatic fire detectors, manual call points are installed in parking garages so that a fire alarm can also be triggered manually.

The number of automatic fire detectors is based on the size of the parking garage; a monitoring area of 60 m<sup>2</sup> per detector should not be exceeded.



In order to guarantee fire detection as early as possible and exclude the risk of false alarms, the fire detectors should be positioned above the parking spaces (not above the access lanes). During positioning, ventilation conditions must also be borne in mind so that in the event of a fire, the fire aerosols are not excessively diluted in the vicinity of the fire detectors

It is also essential to alert all persons present in the vicinity of the garage that a fire alarm has been activated. The example shown in this application guide is based on an underground parking facility in a small hotel, where sounder beacons can provide a cost-effective solution. These devices should be positioned on the ceiling above the centerline of the access lanes. The number and spacing of the devices will be determined by project-specific (audibility and visibility) considerations, together with local codes of practice.

Where local codes of practice require that a voice alarm system is installed (e.g. in larger hotels), the underground parking facility will also be equipped with appropriately positioned and dimensioned loudspeakers. Such systems have the advantage of delivering clear voice messages even in acoustically challenging environments. It has been proven that people react more quickly and more reliably to spoken messages than they do to audible or visual signals. This can make a significant contribution to the speed and efficiency of any evacuation procedure. Specific instructions could also be addressed directly to those persons in the parking facility via microphone from the fire-brigade panel.



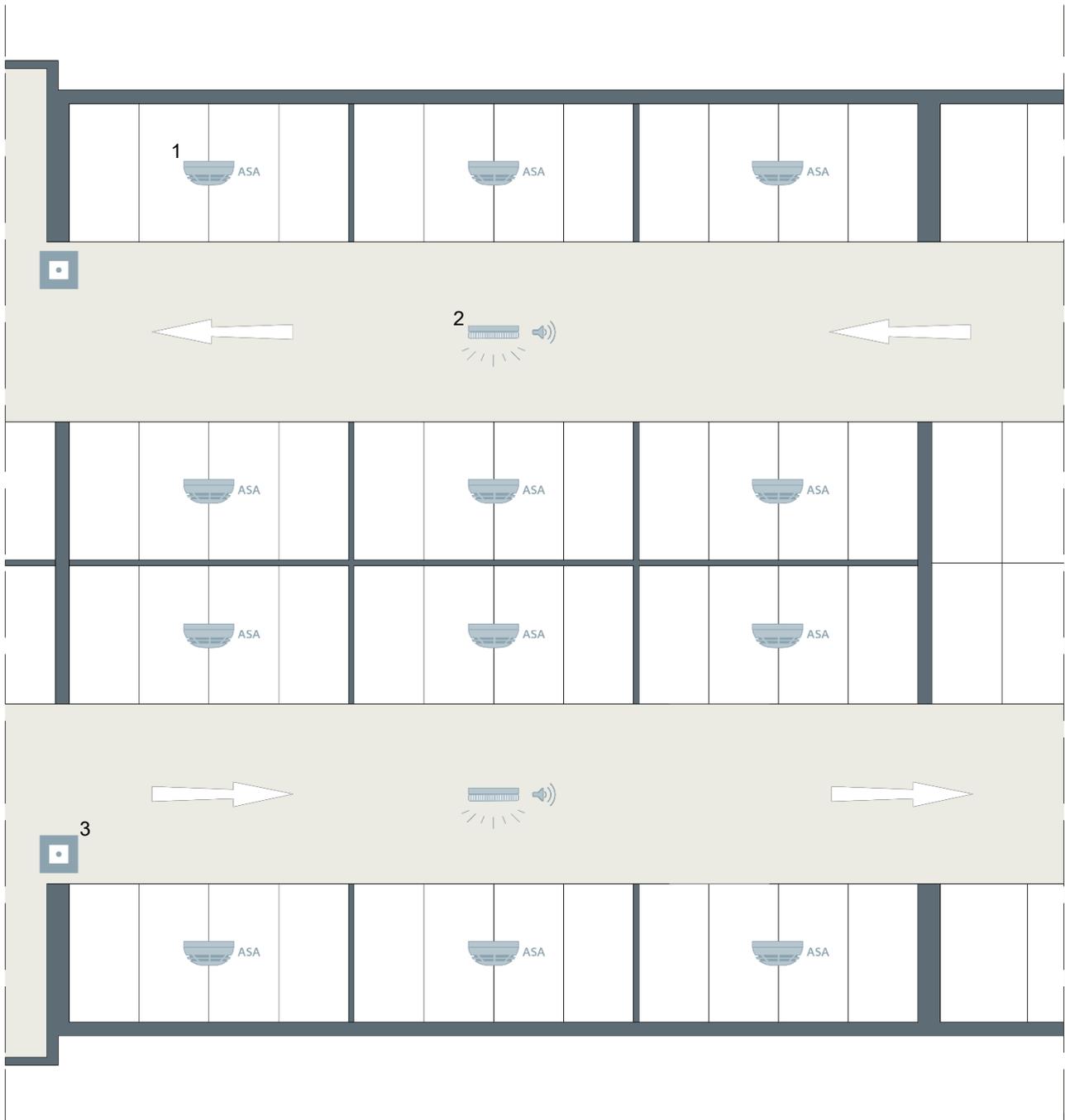


Figure 1 Positioning of system elements:

1. ASA neural fire detector
2. Sounder beacon base with blanking plate
3. Manual call point

Details	Comments/Notes
<p><b>Automatic fire detectors</b> ASA neural fire and CO detectors</p>	<p>Early detection of all types of fire and robust behavior toward deceptive phenomena (exhaust emissions). Monitoring of the CO concentration.</p> <ul style="list-style-type: none"> <li>▪ For fire detection: Parameter set with balanced behavior</li> <li>▪ For CO monitoring: Parameter set with robust behavior</li> <li>▪ IP protection of at least IP43</li> </ul> <p>If an autonomous CO warning system has been installed, ASA neural fire detectors without CO sensors can be used.</p>
<p><b>Manual call points</b> MCPs</p>	<ul style="list-style-type: none"> <li>▪ Single or double action (depending on local regulations)</li> <li>▪ IP protection of at least IP43 (for operation in a harsh environment)</li> </ul>
<p><b>Warning devices</b> Sounder beacons</p>	<p>Provide optimal visual and acoustic warning to garage occupants</p> <ul style="list-style-type: none"> <li>▪ Ceiling-mounting requires a sounder-beacon base with a blanking plate</li> <li>▪ Beacons may be white or red LEDs, depending on local regulations or project-specific considerations</li> </ul>
<p><b>Positioning of system elements</b> (see Figure 1)</p>	<p><b>Automatic fire detectors</b></p> <ul style="list-style-type: none"> <li>▪ On the ceiling, above the parking spaces</li> <li>▪ At least 0.5 m from the wall</li> <li>▪ Away from the airflow of the ventilation system</li> </ul> <p><b>Manual call points</b></p> <ul style="list-style-type: none"> <li>▪ Next to the exits and entrances</li> <li>▪ At a height of 1.4 m ± 0.2 m</li> </ul> <p><b>Sounder beacons</b></p> <ul style="list-style-type: none"> <li>▪ On the ceiling, along the access lanes</li> <li>▪ The distance between neighboring devices will be determined by local codes of practice and project-specific considerations</li> </ul>
<p><b>Related measures</b></p>	
<ul style="list-style-type: none"> <li>▪ Fire extinguisher (powder extinguisher for Fire Categories A, B and C).</li> <li>▪ Wall hydrant or sprinkler system.</li> </ul>	

## Practical experience

### Fire detection

In the past, smoke detectors were only used sporadically in parking garages because the exhaust emissions caused too many false alarms. Point-type heat detectors were often used which triggered an alarm when there was a significant temperature increase, or a maximum temperature was reached (typically 60 °C). In large parking garages, linear heat detectors (sensor cables or heat sensor pipe systems) were also used.

Modern fire detectors are able to make an intelligent signal analysis and the detection behavior can be adapted to the environmental conditions. They can be set to respond very robustly to exhaust emissions. This provides significantly improved fire monitoring because, in addition to an open fire, a smoldering fire can also be detected automatically and early.

### Exhaust emissions as a deceptive phenomenon

Aerosols and increased temperature are the fire characteristics which are detected by a multi-sensor fire detector (optical and thermal). Emissions are generated whenever the engine of a vehicle is started (or is running) and these emissions are also detected by the optical sensor of such a detector.

Practical experience has shown that the ASA neural fire detector can differentiate very well between real fire characteristics and exhaust emissions, thanks to its signal processing with **ASAtechnology** (ASA – Advanced Signal Analysis). If such detectors are operated with the correct setting, the risk of unwanted alarms can be practically excluded.

### Interference from the ventilation system

To guarantee reliable fire detection, the fire detector must be mounted away from the airflow of the ventilation system so that, in the event of a fire, the smoke is not diluted in the vicinity of the detectors.

## Alarming and evacuation

Parking garages present an acoustically challenging environment due to the ambient noise levels and echoing caused by the concrete floors and ceilings. In such applications, suitably positioned sounder beacons provide a reliable and cost-effective solution. In large hotels, where a voice-alarm system is installed, the advantage of spoken evacuation messages can help to improve the efficiency of any evacuation process, should this become necessary. However, the voice sounder beacons are not generally suitable for such environments, as they have been specifically designed to provide optimal understandability in smaller, less acoustically challenging areas, such as hotel guestrooms etc.

As mentioned above, the noise level in parking garages can be high. Being able to alert persons in the area both optically and visually, sounder beacons automatically increase the awareness of a warning in a noisy environment. Stimulating two senses can also help to shorten evacuation times.

### Service life

The design of modern fire detectors means it is possible to significantly reduce contamination compared with older detectors. Additionally, intelligent detectors are equipped with automatic signal tracking so that low to medium contamination in the metering chamber does not affect the detection behavior.

## ASAt echnology

### For intelligent, reliable fire detection with genuine alarm guarantee

ASAt echnology is a unique technology from Siemens that converts signals into mathematical data which are compared with programmed values in real time using intelligent algorithms. The special signal analysis process is very reliable in preventing false alarms caused by on-site deceptive phenomena, such as steam, tobacco smoke or exhaust emissions. Find out more about **Sinteso** or **Cerberus PRO** fire detectors with ASAt echnology.

## Everything you need for comprehensive fire protection

Incorporated in a concept tailored to your customers' requirements, Siemens and its Solution Partner network provide

- Early and reliable fire detection solutions, offering an unrivalled financially backed "Genuine Alarm Guarantee"
- Fully forwards and backwards compatible systems, to ensure any system provided is equipped to integrate the latest technology Siemens has to offer
- Clear and fast alerting and evacuation processes
- Appropriate response measures, e.g. reliable and fast extinguishing

All these aspects are at the core of comprehensive fire protection. Only when these are fulfilled can you be assured that people in your buildings are safe and assets and business operations are protected.

In order to offer your customers peace of mind, Siemens and its Solution Partner network have a variety of service and solution offerings that can be tailored to an individual client's needs. To find out more about this, please visit our Website at <http://www.siemens.com/firesafety-markets> or contact your local Siemens organization through the [online contact form](#).

## Share the experience

With our dedicated program for consulting engineers, you can benefit from our extensive application know-how and complete portfolio.

With Siemens, you can offer your customers comprehensive fire safety for any application and environmental condition. Your customers will appreciate this as it enables them to reliably protect people, assets and business processes from fire.

Backed by more than 160 years of experience in the field, our offerings for early detection, reliable alarming, orderly evacuation and safe extinguishing are based on innovative and unique technologies. They provide you with convincing arguments like maximized life safety or environmental friendliness, and open the door to strong, long-term customer relationships. And with Siemens, you gain a reliable partner at your side and benefit from our smart tools, in-depth trainings and personal support – wherever you are, wherever you go.

For more information please visit our dedicated [consultant page](#).

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Creating environments that care.  
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