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# Fire detection 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 are 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.



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# Content

# Introduction

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 sections.
- 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 to be equipped with a CO warning system.

## Highlights*

- 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

* NFPA, U.S. Hotel and Motels Structure Fires; U.S. Fire Administration's (USFA's) , Hotel and Motel Fires

# Basic conditions

**Objective**

- 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 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 car fire is very difficult and is possible only in a limited way with a sprinkler system.

# 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.).

That is why, in enclosed parking garages, automatic fire detectors must be used which detect the start of a fire early and reliably, but also respond robustly to exhaust emissions. It is also important that the service life of the fire detectors in such a harsh environment 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 $m^2$ 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.

| Details | Comments/Notes |
|---|---|
| **Automatic fire detectors:** ASA neural fire and CO detector | Early detection of all types of fires and robust behavior toward deceptive phenomena (exhaust emissions). Monitoring of the CO concentration.<br>• For fire detection: parameter set with balanced behavior<br>• For CO monitoring: parameter set with robust behavior<br>• IP protection of at least IP43<br><br>If an autonomous CO warning system has been installed, ASA neural fire detectors without CO sensors can be used. |
| **Manual call points:** | Manual call points<br>• single or double action (depending on local regulations)<br>• IP protection of at least IP43 (for operation in a harsh environment) |
| **Positioning of the detectors:** (see Fig. 1) | Automatic fire detectors<br>• On the ceiling, above the parking spaces<br>• At least 0.5 m from the wall<br>• Away from the airflow of the ventilation system<br><br>Manual call points<br>• Next to the exits and entrances<br>• At a height of 1.4 m ± 0.2 m |
| **Related measures**<br>• Sounder beacon to warn people in the parking garage.<br>• Fire extinguisher (powder extinguisher for Fire Categories A, B and C).<br>• Wall hydrant or sprinkler system. | |

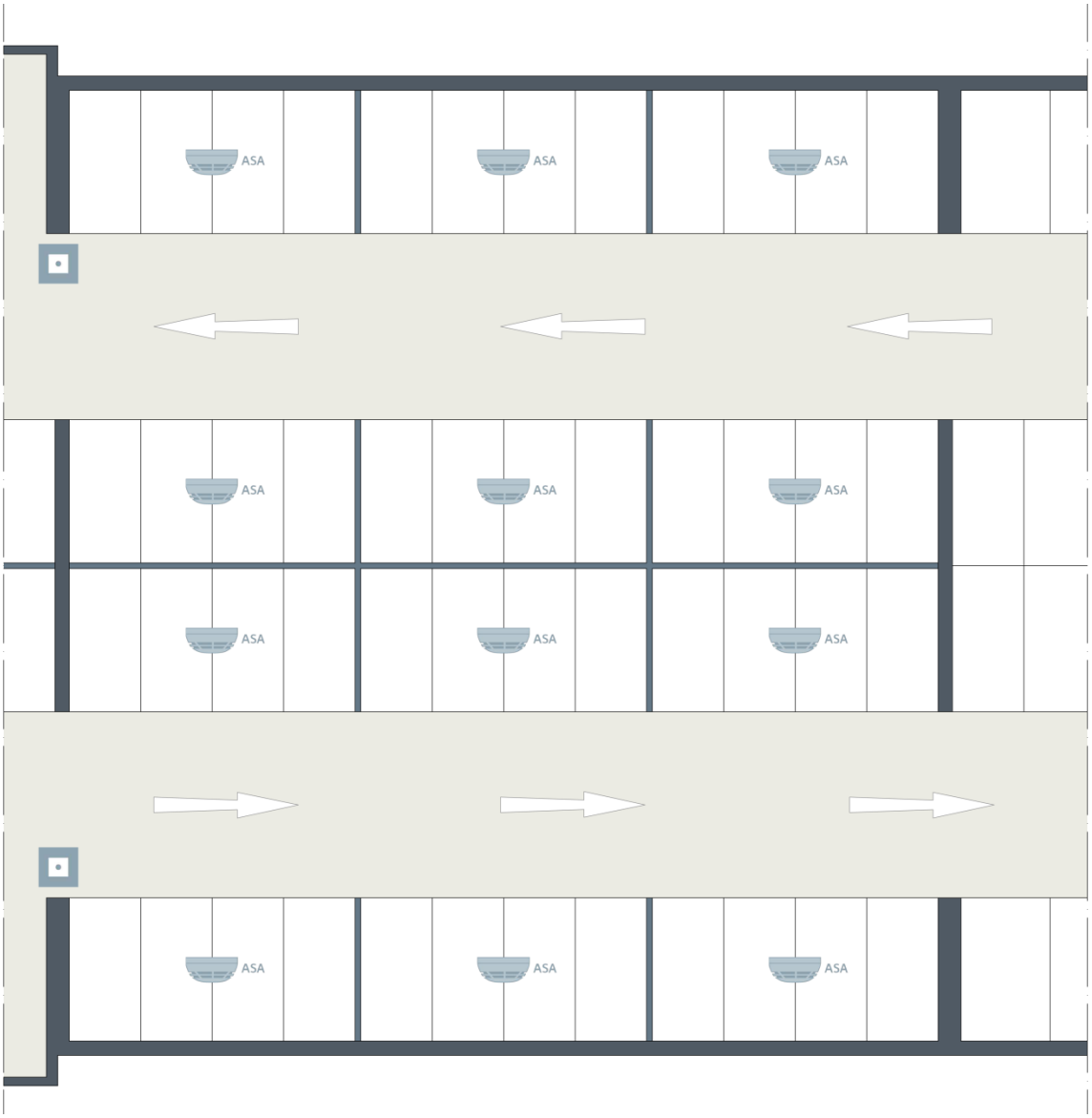


**Figure 1 Positioning of fire detectors**


ASA neural fire detector

Manual call point

# 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 **ASA***technology* (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.

### 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.

# **ASA***technology* – for intelligent,reliable fire detection with genuine alarm guarantee

**ASA***technology* is a unique technology from Siemens that converts signals into mathematical data which is 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 **ASA***technology*.

# 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 able to integrate the latest technology Siemens has to offer
- Clear and fast alerting and evacuation processes

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 Web site at www.siemens.com/firesafety-markets or contact your local Siemens organization through the online contact form.



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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 www.siemens.com/advantage-engineering.



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**Answers for infrastructure and cities.**

Our world is undergoing changes that force us to think in new ways: demographic change, urbanization, global warming and resource shortages. Maximum efficiency has top priority – and not only where energy is concerned. In addition, we need to increase comfort for the well-being of users. Also, our need for safety and security is constantly growing. For our customers, success is defined by how well they manage these challenges. Siemens has the answers.

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