



POSITION PAPER

ON THE FIRE PROTECTION OF CAR PARKS

2009:6(1)



General Secretary

c/o bvfa - Bundesverband Technischer Brandschutz e.V.

GERMANY

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Eurofeu Sprinkler Section

Field of Activity

All aspects of automatic sprinkler installations, deluge and water mist systems in buildings.

Mission Statement

- Promote and establish common reputable standards of fire safety for the protection of life (including that of the fire fighter), public and private assets and the environment
- Ensure and develop the recognition of the sprinkler industry as a specialist profession.
- Promote the effectiveness and reliability of water based fire fighting systems, i.e. sprinkler systems, water spray systems, water mist systems and foam systems, including design, manufacturing, installation and maintenance.
- Increase the use of waterbased fire fighting systems in Europe wherever this solution is appropriate.
- Inform users, specifiers, politicians, fire brigades, authorities about the benefits of water-based firefighting systems.

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Fire Protection of Car Parks

1. Scope

The purpose of this document is to provide basic information to non-specialists that need to evaluate the fire hazards and the possible fire protection concepts for automatic and non-automatic car parks.

It sets out both the principal benefits of protection with water based fire fighting systems and the known limitations or disadvantages, when compared to alternative protection methodologies. The guidance provided is generic and may need to be modified to suit a particular system or future product developments.

2. Introduction

Car parks are buildings which in themselves present particular problems when fires take place. The building design creates natural horizontal and vertical flues, and the style of architecture increases the dangers with the fire hazards present in such buildings. These hazards include flammable liquids and easily ignitable combustibles, having a high fire load, including plastics, rubber, textiles, etc. (many due to modern innovation), all of which have high heat and smoke generation potential.

Not only is the high fire load of concern, but a more critical aspect is the danger of the fire growing rapidly in the early stages.

The close concentration of cars in large open areas creates a high fire load, a very rapid rate of growth of fire and particular difficulties in locating and fighting such a fire.

Sources of ignition are plentiful, such as cigarette disposal, leaking fuel hoses, damaged electrical cables, etc.. The vast amounts of hot, dense, black smoke created by such a fire, plus the possibility of "flashover" makes the whole scene most dangerous for drivers and passengers who may be trapped in cars or in locations of the building. It is also difficult and dangerous for firefighters who eventually will attempt to control and extinguish the fire.

Toxic smoke penetration into perceived escape routes is a highly dangerous possibility.

The cost of such fires in human, economic and environmental terms is incalculable, and as many of these car parks are in "down town" city locations the consequential costs could be catastrophic.

Unfortunately all these consequences seem to be ignored by investors, owners and the appropriate authorities.



horizontal fire spread 1



horizontal fire spread 2



fully developed fire

3. Protection using sprinkler systems

Automatic sprinkler systems have been installed for well over 100 years in all types and classes of industrial, commercial and residential buildings, and have well proven outstanding success in detecting and suppressing or extinguishing fires and sounding an alarm, resulting in the considerable saving of property (both buildings and contents) and lives.

Advantages of sprinkler systems

- A sprinkler system automatically locates a fire, detects the fire whilst relatively small and either suppresses or extinguishes the fire in the early stages whilst instantaneously giving an alarm.
- There has been continuous development in the design and development of sprinkler systems, and modern installations are highly reliable and yet sensitive in response.
- Only the sprinklers in the immediate vicinity of a fire operate, and they immediately fight the fire with a drenching spray of water and simultaneously give an alarm which can be transformed to a Fire Brigade.
- The spray of water from a sprinkler is much less in rate of flow than needed by the fire brigade, and yet it is more effective because it has operated and controlled the fire whilst relatively small, so reducing the heat, smoke and flames to minimal proportion.
- Consequently, a sprinkler system automatically protects a building, its contents and personnel involved, including firefighters, whilst the fire is quite small and it considerably reduces the extent of the fire involvement.
- When the Fire Brigade arrives, they can immediately locate the fire and they are now faced with much less hazardous circumstances than otherwise would be the case. That means, that sprinkler systems help the fire brigade to do their job in a safe and effective way.
- In many countries sprinkler systems can allow a reduction in the fire rating of "passive" protection, i.e. walls, etc., and can allow larger areas in communication in buildings to be permitted, depending on circumstances.
- The most modern car designs, with increased flammability, are adequately protected by the latest sprinkler system designs because rapid rises in temperature cause earlier operation of the system which prevents faster fire spread, thus causing much less smoke and heat. Although sensitive to rapid heat increases caused by fire, inadvertent operation of a sprinkler system is virtually unknown due to "built in" integrity.



fire test arrangement



smoke generation



sprinkler system working

4. Protection with special ventilation systems combined with electronic fire detection systems

In recent years, new ventilation systems combined with electronic fire detection are being considered as occasionally it may be suggested that such measures eliminate the necessity for fire walls and sprinklers.

Such new technologies may be useful, but they should clearly be considered as an addition to, not in place of, to the well proven automatic fire suppression sprinkler system.

The many different designs of car parks involving automatic and non-automatic parking with differing plan layouts and heights, can raise doubts to the advisability of the sole use of ventilation systems with fire detection. In the table below are comparisons between automatic sprinkler systems and ventilation systems.

| | Ventilation system plus detection | Sprinkler System |
|---|-----------------------------------|------------------|
| Locate the fire | Yes | Yes |
| Locations the fire | Yes | Yes |
| Automatically fight the fire | No | Yes |
| Actively limit the fire size | No | Yes |
| Prevent fire spread | No | Yes |
| Limit the amount of smoke | No | Yes |
| Limit financial consequences to a minimum | No | Yes |

4.1 Detection and location of fire

Electronic detection systems have the facility to detect, locate and give an alarm in the very early stages of a fire. Something then needs to be done with a now rapidly growing fire in a highly obstructed location. Fast action is critical. This is when a reliable automatic fast acting water spraying system (sprinklers) is a vital necessity.

In recent years, the industry has developed a much quicker operating sprinkler which has the same integrity as previous designs (i.e. it is just as resistant to inadvertent operation). Hence, fast growing fires are now detected and suppressed more quickly.

Ventilation systems are not active in fire suppression, and do not limit or control the fire size, nor do they prevent fire spread. After a ventilation system with a detection system has detected the fire, the Fire Brigade will be summoned and they may be ready on site to fight the fire in say 15 or 20 minutes after detection. During this time, the ventilators have to blow the increasing smoke in one direction through the car park into ventilation shafts, and large fans blow out the smoke from the car park. In addition, on the side of the building ventilation intake shafts must be installed to bring in fresh air to compensate the air losses. Consideration needs to be given to the effect on the fire that these increased air quantities and velocities will have.

In the event of a fire, a sprinkler system starts immediately to suppress the fire after the operation of a sprinkler, and the giving of the alarm. Due to the cooling effect of the water, temperatures decrease very quickly and the fire size is reduced and controlled. Fire tests on cars in buildings with sprinklers have shown that fire spread between cars does not occur in sprinklered buildings. By limiting the fire to the area of one car the sprinkler system will give the fire brigade enough time to enter the car park area. Consequently the Fire Brigade would have no problems in achieving final extinguishment. Hence, a sprinkler system enables the Fire Brigade to effect extinguishment much more quickly and safely.

4.2 Financial consequences

Due to the quick response of an automatic sprinkler system causing limitation of fire size, reduced fire spread and limitation of smoke, the financial consequences of a fire in a sprinklered building are reduced to an absolute minimum.

4.3 Automated car park systems

The many different designs of car parks such as automatic and non-automatic need different technical solutions.

For automatic car parks, sprinkler systems or, in extreme circumstances, automatic water deluge systems have proven reliability and performance.

4.4 Conclusion:

The purpose of ventilation systems is to clear the hot gases, not to suppress the fire. Ventilation systems may serve as an addition to sprinkler systems, but only if the ventilation system is designed and installed in such a way that it does not interfere with the sprinkler system. This is vitally important. Ventilation systems, producing high "wind" velocities may lead to serious delay in the response of sprinklers and disastrously interfere with the effectiveness of the sprinkler system.

5. Automatic car parks

The situation gets worse in so called automatic car parks. These facilities were especially developed for cities with restricted space, and they allow the parking of many cars in comparatively small areas and volumes by using a rack structure (i.e. cars are stacked vertically as well as horizontally). In order to minimise building costs, such systems also use very small horizontal distances between car stacks. Consequently, a fire will spread to adjacent cars even quicker than in a conventional car park. Furthermore, automatic car parks typically park cars in multiple levels. Consequently the fire will not only spread horizontally but also vertically, and even more rapidly.

The closely packed configuration of automatic car parks, which very much resembles high rack storage in warehouses, reduces the time between the initial fire and a "flashover" situation. A Fire Brigade will not only need to get to the car park very quickly, but it will also have to determine the origin of the fire very rapidly and effect suppression. This is extremely difficult and time consuming in the case of automatic car parks due to the fact that the fire has to be located in a complex three-dimensional structure with very restricted access routes.

If such a fire is not controlled very rapidly and whilst small, then within minutes not only the volume of the car park but potentially the city area around the car park building will be filled with toxic smoke, resulting in collateral damage even worse than that experienced with conventional car parks. Also, if such a fire is not detected and controlled very quickly (i.e. within minutes) temperatures will increase exponentially resulting in damage to the steel structure as well as to the remainder of the building.

Due to the foregoing, in Germany automatic car parks with more than 20 car spaces and in Spain all car parks are required to be protected by an approved sprinkler system.

The installation of a sprinkler system customised to the car park geometry can limit a fire to a single car whilst simultaneously giving an alarm. This gives the Fire Brigade the necessary time to get to the fire and, with hoses and branchpipes, to effect extinguishment.

In such occupancies as automatic multi-stack car parks, the addition of foam to the sprinkler system is highly recommended as it has the ability to spread an extinguishing facility over any liquid pool fires, contribute to the effectiveness of extinguishment in general, and minimise re-ignition potential.

6. Building regulations

Due to the foregoing, some of the European countries require sprinkler protection in car parks, especially for underground car parks and/or automatic car parks

7. Table of Comparisons

| | Fire detection system plus (special) ventilation system | Sprinkler system |
|---|---|------------------|
| Technical criteria | | |
| Reduction of the amount of heat produced by the fire | NO | YES |
| Reduction of the amount of smoke produced by the fire | NO | YES |
| Preserving of the structural integrity of the building | POSSIBLY | YES |
| Ensuring of evacuation conditions for people | DOUBTFUL | YES |
| Fire detection | YES | YES |
| Automatic alarm transmission | YES | YES |
| Ensuring of safe access to the fire for the fire brigade | NOT PROVEN | YES |
| Reduction of environmental pollution | NO | YES |
| Economic criteria | | |
| Reduction of business interruption of car park in case of fire | NO | YES |
| Reduction of costs for other fire protection means | NO | POSSIBLY |
| Limitation of damage to cars in the car park | NO | YES |
| Limitation of damage to the technical equipment of the car park | NO | YES |

Published by:



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