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BSI Standards Publication

Components for smoke and heat control systems –

Part 7: Code of practice on functional recommendations and calculation methods for smoke and heat control systems for covered car parks

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 42, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 7346 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 August 2013. It was prepared by Technical Committee FSH/25, *Smoke, heat control systems and components*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 7346 supersedes BS 7346-7:2006, which is withdrawn.

Relationship with other publications

BS 7346 is published in the following parts:

- *Part 4: Functional recommendations and calculation methods for smoke and heat ventilation systems, employing steady-state design fires – Code of practice;*
- *Part 5: Functional recommendations and calculation methods for smoke and heat ventilation systems, employing time-dependent design fires – Code of practice;*
- *Part 7: Code of practice on functional recommendations and calculation methods for smoke and heat control systems for covered car parks.*

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- car parks with stacker systems;
- reference to guidance on the ventilation of loading bays and coach parks.

Use of this document

As a code of practice, this part of BS 7346 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 7346 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

Background to smoke control in car parks

Ventilation of covered car parks is usually recommended in order to limit concentrations of carbon monoxide (CO) and other vehicle emissions in the day-to-day use of car parks and to remove smoke and heat in the event of a fire. The same equipment is often used to satisfy both requirements. This standard, recognizing the dual use of such systems, also provides guidance on usage for vehicle emission ventilation.

The recommendations in this standard are provided for smoke and heat control systems installed in car parks, with or without sprinkler protection. The main benefit of sprinklers is to control the size of fire to be dealt with by the fire and rescue service. This is reflected in the design fire sizes recommended for car parks with and without sprinklers.

NOTE In 2006, the Department for Communities and Local Government (DCLG) commissioned the Building Research Establishment Group (BRE) to carry out a three-year project on fire spread in car parks [1]. The work included a series of 11 full-scale fire tests, including two cars on a "stacker" test rig. The data has been used to validate the appropriateness of the steady-state design fires quoted in this document. Where a time-dependent design fire is used, the data within the report can be referenced where appropriate.

Car park ventilation systems can be designed for one or more of three purposes in the event of a fire:

a) to assist fire-fighters to clear smoke from a car park during and after a fire;

b) to provide relatively smoke-free access for fire-fighters to a point close to the seat of the fire;

c) to protect means of escape from the car park.

At the time of publication, smoke control is not required in UK legislation to provide relatively smoke-free access or protect means of escape in car parks. Nevertheless, it is possible in some cases to design a ventilation system that will assist both. Smoke and heat exhaust ventilation systems (SHEVS) or impulse ventilation systems might be suitable.

The system requirements differ depending upon the purpose. Not all types of ventilation systems are suitable for all purposes. Recommendations and criteria are provided for the design of systems for all three purposes.

Clearance of smoke during the fire and after the fire has been suppressed will assist in search and rescue operations, checking for primary and additional seats of fire, as well as returning the building to its normal use.

a) *To assist fire-fighters to clear smoke from a car park during and after a fire.*

Smoke clearance systems are intended to assist fire-fighters by providing ventilation to allow speedier clearance of the smoke once the fire has been extinguished. The ventilation might also help reduce smoke density and temperature during the course of a fire. These systems are not specifically intended to maintain any area of a car park clear of smoke, to limit smoke density or temperature to within any limits, or to assist means of escape.

It is possible that some smoke clearance systems could actually worsen conditions for means of escape if set in operation too early by encouraging smoke circulation and descent of the smoke layer. For this reason it might be preferable to either delay operation after automatic actuation or to provide only manual actuation from a fire service override switch.

b) *To provide relatively smoke-free access to fire-fighters to a point close to the seat of the fire.*

Relatively smoke-free access is provided specifically in order to assist fire-fighters in carrying out fire-fighting operations. The system is designed to operate automatically in response to a suitable fire detection system and ensures relatively smoke-free access by fire-fighters to a point close to the seat of the fire. Primarily, such systems assist fire-fighting by:

1) detecting the origin of the fire to a specific location in the car park, allowing easier identification by fire crews;

2) moving the smoke and heat from that location towards a specific extract point or points;

3) creating a relatively smoke-free approach zone or bridgehead clear of the fire. This allows fire-fighters to assemble personnel and equipment in favourable conditions and fire-fighting operations to be carried out more quickly, safely and efficiently.

Because of 3), it is vitally important that the location of all fire-fighting access points into the car park are accounted for during the design process. It is of little benefit if the smoke and heat is moved towards, for example, the only access route available to fire-fighters for fire-fighting purposes.

In large or complex car parks where impulse fans are employed, there might be multiple extract points. Such systems could be configured to move the smoke in one of several directions, depending on the location of the fire. Again, it is important to ensure that there are suitably located fire-fighting access points to allow the bridgehead to be created for each design fire scenario considered.

In addition, correctly designed smoke and heat control systems of this type could also prove advantageous to fire-fighters by diluting and cooling smoke and preventing the build-up of high local temperatures. As a result, it is possible to install them as part of a fire-engineered solution or as compensation for the lack of other fire protection measures, e.g. sprinklers.

It is important that the design of no smoke and heat control system, when installed, worsens the level of safety for occupants and fire-fighters, using as a basis for comparison above-ground car parks with natural cross-ventilation with permanent openings.

c) *To protect means of escape from the car park.*

Where smoke and heat control systems are installed in car parks for purposes other than protecting the means of escape, there is a need to avoid smoke prejudicing escape. If there is any concern that automatic operation of a smoke and heat control system could prevent persons from escaping, it is preferable to either select an alternative system design or introduce an appropriate delay period before full activation of the system.

Smoke ventilation recommendations in car parks are outlined in *The Building Regulations Approved Document B* [2], *The Building Regulations (Northern Ireland) Technical Booklet E* [3] and *Scottish Building Standards Technical Handbooks* [4]. These guidance documents recommend provision of systems for purpose a), smoke clearance, only. Systems for purposes b) and c) are therefore usually provided either as part of a fire engineered solution or as a compensating feature for other fire protection measures that might not fully conform to those recommendations.

The following types of ventilation might be considered as alternatives and recommendations on the design criteria for each are given in this British Standard:

- natural ventilation (see Clause **7**);
- ducted mechanical ventilation (see Clause **8**);
- impulse ventilation (see Clauses **9**, **10** and **11**);
- smoke and heat exhaust ventilation system (SHEVS) (see Clause **12**).

Further considerations

Any ventilation system, unless permanently open, is dependent upon suitable power supplies and controls for correct operation.

Ventilation systems interact with other building services and fire protection systems in normal operation, whether by design or as a by-product of operation.

In some car parks, especially underground car parks associated with residential buildings, there are storage areas accessed directly from the car park. These are used by residents to store personal possessions, and thus such storage areas will contain materials which are not known to the designer since there is no control over such private areas.

1 Scope

This part of BS 7346 gives guidance on functional recommendations and calculation methods for smoke and heat control systems for covered parking areas for cars and light commercial vehicles.

NOTE 1 It is assumed that cars powered by fuels other than petrol or diesel will have a fire performance similar to vehicles powered by petrol or diesel. This assumption might be revised in a future edition of this standard if further information suggests it is necessary.

It is intended for system designers, installers of systems, regulatory authorities, for example building control officers and fire safety officers, and those who manage the fire safety of car parks.

It gives recommendations for systems designed for open-sided car parks and for enclosed car parks. It covers:

- systems intended to protect means of escape for occupants of the car park or the building housing the car park;
- systems intended to assist active fire-fighting operations; and
- systems intended to provide smoke clearance following suppression of a fire.

It includes recommendations for natural open-sided ventilation and for ducted mechanical ventilation. It includes guidance on performance-based smoke control using impulse ventilation systems and smoke and heat exhaust ventilation systems (SHEVS). Time-dependent and steady-state design methods are included as appropriate for each smoke control approach. Control of vehicle pollutant emissions is included where it influences the optimization of smoke control. Following the BRE fire tests on car stacker systems, it also includes recommendations for fire sizes and fire suppression in these types of installations.

Smoke and heat control systems for loading bays and coach parks are not covered by this standard.

NOTE 2 Guidance on loading bays and coach parks can be found in the FETA publication, Design of smoke ventilation systems for loading bays and coach parks – a guide for system designers *[5].*

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5839-1, *Fire detection and fire alarm systems for buildings – Part 1: Code of practice for system design, installation, commissioning and maintenance*

BS 7346-4:2003, *Components for smoke and heat control systems – Part 4: Functional recommendations and calculation methods for smoke and heat exhaust ventilation systems, employing steady-state design fires – Code of practice*

BS 7346-5:2005, *Components for smoke and heat control systems – Part 5: Functional recommendations and calculation methods for smoke and heat exhaust ventilation systems, employing time-dependent design fires – Code of practice*

BS 7671, *Requirements for electrical installations – IET wiring regulations – Seventeenth edition*