

Sprinkler Systems - Ordinary Hazard Design Calculation Principles

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This LPS document provides an overview of the considerations needed when determining which sprinkler system calculation method to use.



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Introduction

There are two options when it comes to sizing sprinkler system pipework and water supplies within the LPC Rules for Automatic Sprinkler Installations Incorporating BS EN 12845 (LPC Rules), these are:

- Pre-Calculated
- Full hydraulic calculations (FHC)

Sprinkler systems protecting High Hazard (HH) occupancies must utilise the FHC method, however systems protecting Ordinary Hazard (OH) occupancies, defined as occupancies where combustible materials with a medium fire load and medium combustibility are present; processed or manufactured e.g. offices, retail premises and schools, can be sized using either method. The method chosen at the beginning of the project should always be used for any future alterations or extensions to ensure the water supplies remain adequate for the sprinkler system.



Calculation Differences

Pre-Calculated Systems

- This type of system uses predetermined pipe sizes for ranges and distribution pipes downstream of a design point (typically the pipe supplying 18 sprinklers) and calculated pipe sizes for the mains from a design point back to the alarm valve (pressure loss calculations).
- Sprinkler pumps duties and tank capacities are selected from pre-determined tables.
- Additional connections can be installed upstream of the design point without affecting the pressure loss calculations providing no more than 18 new sprinklers are installed.
- Modifications to sprinkler head layouts will have no impact on the pressure loss calculations or pipe sizes, providing no new sprinklers are being installed.
- If additional sprinklers are to be installed, only the pressure loss calculations from the design point back to the alarm valve are required.

Full Hydraulic Calculation Systems

- FHC systems are based on calculating the flow and pressure required for all operating sprinklers in an Assumed Maximum Area of Operation (AMAO). The AMAO can vary between 72m² and 360m² depending on the hazard category.
- Sprinkler pump duties and tank capacities are selected based these calculations.
- All pipe sizes are to be determined through full calculations.
- There is no limit on the number of sprinkler heads that must be included within the AMAO as it is determined by floor area and not a set number of sprinkler heads. This therefore may include a considerable number of sprinkler heads where additional sprinkler heads have been installed below obstructions and due to complex ceiling designs.
- Any alteration to a sprinkler system based on FHC principles will require full calculations to be carried out to determine the water supplies are still adequate, including the pump duties and sprinkler tank capacity.
- Altering sprinkler head location/coverage areas can alter the pressure and flow required at the sprinkler head. Reducing the coverage areas could result in more sprinklers being included within the AMAO and increase the pressure and flow requirements.

- The AMAOs are determined based on the hydraulic demand and not geographical location, therefore additional sprinkler heads could result in an AMAO moving to a different part of the system. This can impact the pipework sizes and the water supply requirements.

Calculation Method Selection

Both pipe sizing methods have advantages and disadvantages depending on the occupancy in question, below shows some points to take into consideration prior to commencement of design.

Basebuild	
Pre-Calculated	Full Hydraulic Calculations
<ul style="list-style-type: none"> • Level 2, 3 & 4 LPCB listed sprinkler companies can carry out pre-Calculated basebuild design work. • Reduced design timescales. • Available pressure losses at floor/tenancy connection points can be provided. • Pumps and Tank are selected based on the hazard classification and height of the building and therefore can be procured at an earlier stage of the project. • Cannot be used when the ceiling void is used as an air conditioning plenum. • Any sprinkler heads requiring a higher operating pressure cannot be used e.g. Window Sprinklers (Please refer to Aviva LPS). 	<ul style="list-style-type: none"> • Only Level 3 and 4 LPCB listed sprinkler companies can carry out FHC work. • Longer design timescales due to extensive calculation process. • Pumps and tank cannot be confirmed until much later in the design process as they are affected by the pipework and head layouts. • Can be used when ceiling void is used as an air conditioning plenum. • Potential for smaller pipework sizes. • Potential for smaller capacity tank being required. • Higher pressure sprinkler heads can be incorporated into the system. • Final calculation documentation required to be issued to enable future modification works to be correctly designed.

Post-Basebuild Work	
Pre-Calculated	Full Hydraulic Calculations
<ul style="list-style-type: none"> • All levels of LPCB listed sprinkler companies can carry out pre-calculated extension & alteration work. • Changes to head layouts to suit partitions etc. is simple and can be done without requiring new pipe size calculations. • If available pressure losses at floor connection points are provided, then fit out and modification calculations only need to be run back to the connection point. • Reduced design timescales. • Any sprinkler heads requiring a higher operating pressure cannot be used e.g., Window Sprinklers (Please refer to Aviva LPS). 	<ul style="list-style-type: none"> • Only Level 3 and 4 LPCB listed sprinkler companies can carry out FHC work. • Any alterations require a new calculation to be run which could be restrictive for Category B alterations as water supplies are tailored to the original design. • Previous calculation data for the whole system is required to be able to carry out calculations for modifications and extensions. • Longer design timescales due to extensive calculation process • Higher pressure sprinkler heads can be incorporated into the system. • Final calculation documentation required to be issued to enable future modification works to be correctly designed.

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Additional Information

Relevant Loss Prevention Standards include:

- **Sprinkler Systems – How They Operate**
- **Sprinkler Systems – Review of Hazard**
- **Sprinkler Systems – Flexible Connections**
- **Sprinkler Systems – Window Sprinklers**
- **Sprinkler Systems – Winter Precautions**
- **Sprinkler Systems – Meeting Pods**
- **Sprinkler Systems – Acoustic & Decorative Panels**

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