

The Essential Guide to Fire Suppression in High-Rise Residential Buildings



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Welcome to the Essential Guide to Fire Suppression in High-Rise Residential Buildings.

This guide will help you understand the potential uses of water-based fire suppression systems in high-rise residential buildings. It covers the regulatory context in England in particular (though parts of the new fire safety regime also apply in Scotland, Wales and Northern Ireland) and the technical standards, testing, inspection and certification processes that can help foster trust in these systems.

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A global leader in applied safety science, UL Solutions transforms safety, security and sustainability challenges into opportunities for customers in more than 100 countries. We deliver testing, inspection and certification services, together with software products and advisory offerings, that support our customers' product innovation and business growth. UL certification Marks serve as a recognized symbol of trust in our customers' products and reflect an unwavering commitment to advancing our safety mission.

What is fire suppression?

Fire suppression refers to the methods and technologies used to control, contain or extinguish fires. Its purpose is to prevent or minimise potential damage to life, property and the environment. Fire suppression systems and strategies are essential components of active fire safety.

In the United Kingdom (U.K.), fixed fire suppression technology tends to be wet fire sprinkler systems or water mist systems. Both are common in newbuild high-rise residential buildings but are not yet included in most building refurbishment programmes.





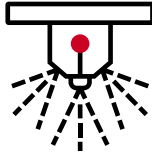
Fire sprinklers

According to research by the National Fire Chiefs Council in 2017, fire sprinkler systems effectively control fire in more than 99% of cases (across a wide range of buildings) and have an operational reliability of 94%.

Sprinklers or water mist nozzles activate because of heat from a fire. Once the heat-responsive element — a glass bulb or eutectic-type element — responds to the heat, water is released from the sprinkler or nozzle, dousing the fire area.

Smoke does not affect sprinklers, and only the sprinkler closest to the fire will operate. According to 2021 research from the National Fire Protection Association (NFPA), statistics in the United States (U.S.) show that in 77% of all fires in buildings with fire sprinkler systems, only one nozzle was needed to control the fire.

Sprinklers are strategically installed to suppress fires in specific areas or to protect critical equipment and valuable assets. The use of fire sprinklers nearly eliminates fire deaths, reduces injuries by at least 80%, reduces property damage by 90% and substantially reduces damage to the environment from fire (source: BAFSA).



Water mist

In contrast to sprinklers, which have been in use for more than 150 years, modern water mist systems are a relatively new technology. They were used widely in the maritime sector in the 1990s, but are now considered a viable alternative to fire sprinkler systems in many other settings. These systems are particularly suited to areas susceptible to water damage, such as heritage buildings and libraries.

Water mist systems provide fire suppression by creating a very fine spray of water droplets of less than 1,000 μm (1 mm), designed to cool through evaporation. The water droplets get to the seat of a fire either by air convection or pressure, at which point they evaporate into steam, displacing the oxygen needed for combustion and suffocating the fire.

Nozzles for mist systems typically release about 2-25 litres of water per minute. This is considerably less than a sprinkler system, and only the nozzles situated in the fire area release the mist.

Although similar in appearance to fire sprinklers, water mist systems differ in many ways, including operation, equipment, building requirements, certification requirements and inspection protocols.

It is important to consider insight on which fire suppression system to use.

Choosing the right system

The [Fire Protection Association \(FPA\)](#) provides the following list of factors to consider when choosing a fire suppression system:

- Hazards and risks
- Effectiveness against such risks
- Fire strategy
- Longevity of water supply
- Standards, research and testing
- Third-party approvals
- Proven track record
- Insurability
- Cost
- Space for water tanks, etc.

The regulatory context

Since the Grenfell Tower tragedy in 2017, the new [Building Safety Act 2022](#) and updates to building regulations have changed the rules about sprinklers and water mist systems for some residential buildings in England.

Higher-Risk Buildings Regulations 2023

On 6 April 2023, [Higher-Risk Buildings Regulations 2023](#) came into force for England and Wales. These regulations provide details on relevant information, such as how height is measured (from ground level to the top of the floor surface on the top floor), whether rooftop plant rooms should be counted (they shouldn't) and what to do about measuring extensions (still measure from the ground level).

A point to note

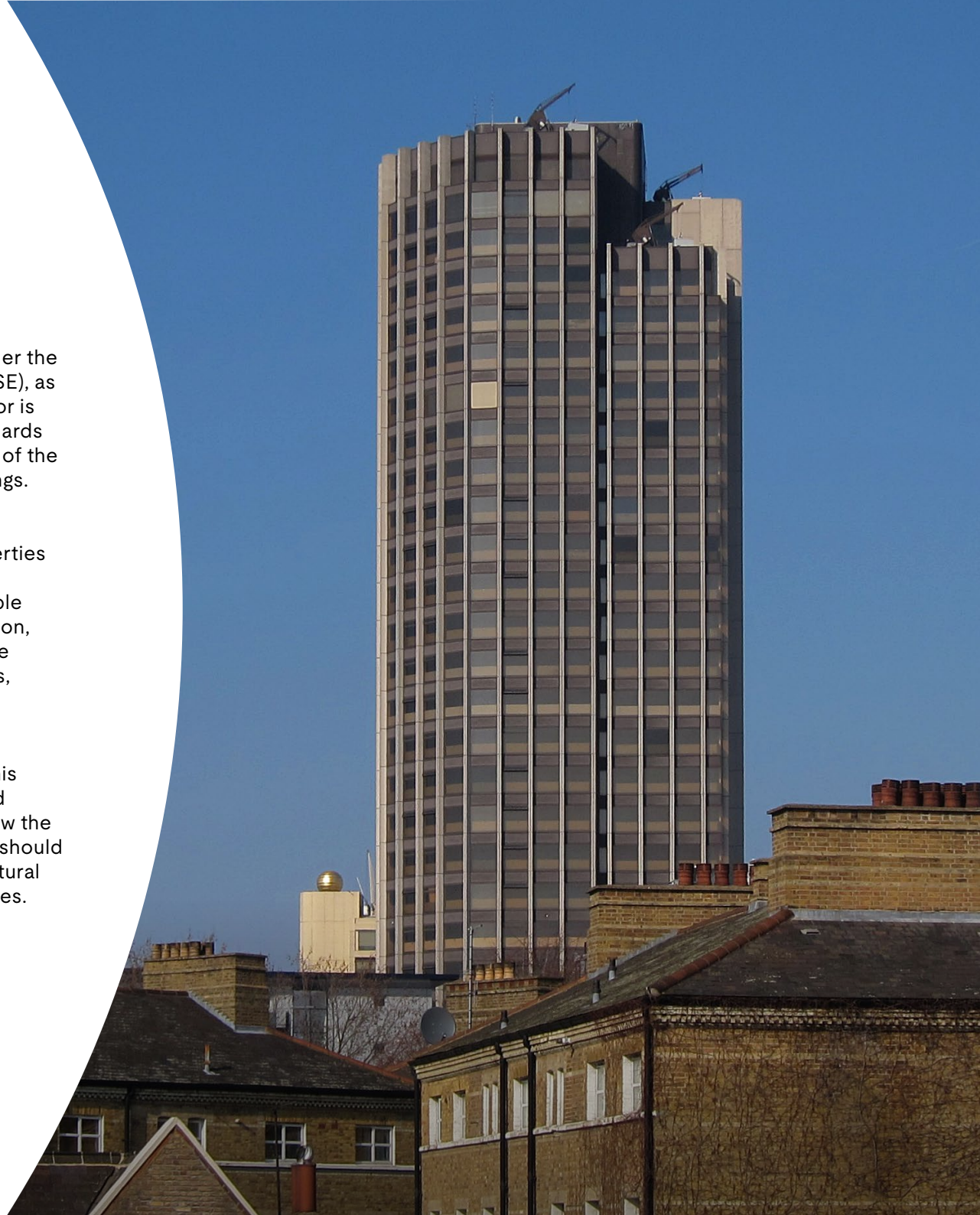
While the [Building Safety Regulator](#) tends to refer to “high-risk residential buildings,” the Building Safety Act legislation talks about “higher-risk buildings” — specifically, buildings at least 18 metres in height or at least seven storeys, containing at least two residential units. (The definition also applies to hospitals and care homes during design and construction but not during operation because other, pre-existing legislation already covers these buildings).

Building Safety Regulator

The Building Safety Regulator is a new body under the auspices of the Health and Safety Executive (HSE), as required by the Building Safety Act. The regulator is responsible for overseeing the safety and standards of all buildings and for ensuring implementation of the new regulatory framework for higher-risk buildings.

As of 1 October 2023, owners and managers of higher-risk buildings have to register their properties with the regulator. Additionally, a designated accountable person (AP) or principal accountable person (PAP) must submit key building information, including details on the building's fire and smoke control equipment, such as sprinklers or misters, within 28 days of a building's registration.

The PAP must prepare and submit a safety case report for the building to the regulator. Within this document, the PAP identifies significant fire and structural hazards for a building and explains how the PAP is managing and controlling them. The PAP should describe how they are preventing fire and structural failure and how they are limiting its consequences.



Building regulations

Regulations differ across the U.K.

England

Fire safety in buildings in England is guided by [Approved Document B of the Building Regulations](#) – sometimes called Part B – which was amended to match the Building Safety Act with the new version of Part B that came into force in November 2020.

As part of these amendments, the threshold height for sprinklers was lowered. Sprinklers should now be installed in new blocks of flats or mixed-use buildings at 11 metres. This also applies in situations that cause material alterations, material change of use or extensions to a building.

The Mayor of London has also introduced his own building safety standards, requiring automatic fire suppression systems in all new buildings in the capital.

Wales

Wales was the first country in the world to pass a law requiring sprinklers in all new homes. The [Welsh government](#) regulated an automatic fire suppression system in all new and converted homes and flats in Wales as of January 2016. This also included converted care homes, rooms for residential purposes (other than in a hotel, hospital, prison or short-stay leisure hostel), registered group homes and sheltered housing.

Scotland

Fire suppression systems in Scottish care homes and high-rise blocks of flats above 18 metres had already been mandated for some years. The [Scottish government](#) introduced new regulations in March 2021, requiring all newly built social homes, flats and shared multi-occupied residential buildings in Scotland to be fitted with automatic fire suppression systems.



British, European and international standards

Within the U.K., there are a few life-safety standards that cover the use of fire sprinklers in residential buildings, including:

- BS 9251:2021 — Residential sprinkler systems
- EN 16925:2018 — Residential sprinkler systems
- NFPA 13 (American standard)

The updated 2021 version of BS 9251 represents the latest consensus view on sprinkler design and installation and covers:

- Individual dwellings (houses, flats and maisonettes)
- Houses of multiple occupancy (HMOs)
- Boarding houses
- Blocks of flats
- Residential care premises

For water mist systems, the equivalent British and European standards are:

- BS 8458 — Residential and domestic water mist standard
- EN 14972-1:2020 — Water mist systems
- NFPA 750 (American standard)

Fire suppression systems need to be installed appropriately in the field and undergo periodic inspections, tests and maintenance to ensure a high degree of reliability.

Regular training, maintenance and adherence to safety protocols are essential to supporting the effectiveness of fire suppression efforts. As applications and installation environments continue to diversify, continual monitoring and assessment of fire suppression regulations is also vital.



EN 12259-14

Standards for the manufacture and installation of fire sprinklers date to the late 1800s. For today's U.K. market, residential sprinklers are typically evaluated to [EN 12259-14:2020+A1:2022](#), Fixed Firefighting Systems — Components for Sprinkler and Water Spray Systems — Part 14: Sprinklers for Residential Applications.

Many tests specified in EN 12259-14 investigate the ability of a residential sprinkler to perform as intended over a long period of time, including tests for:

- Physical strength and leakage strength
- Operation
- Exposure and corrosion
- Water flow and distribution
- Fire

While EN 12259-14 was initially published in 2020, UL Solutions developed the fire test described in that standard more than 20 years prior. It has been part of our certification for residential sprinklers for use within the U.S. ever since.

UL Solutions tests and certifies sprinklers and water mist nozzles to the requirements in the current editions of the following standards:

- ANSI/UL 199 — the Standard for Automatic Sprinklers for Fire-Protection Service
- EN 12259-1 — Requirements and test methods for sprinklers
- ANSI/UL 2167 — the Standard for Water Mist Nozzles for Fire Protection Service



Retrofit of fire suppression in high-rise residential buildings

[Research from the University of Leeds](#) in 2021 showed that fires in purpose-built blocks of flats are generally riskier than house fires because it takes longer for firefighters to access the building. The study found that it takes more than 27 minutes on average to respond to a high-rise flat fire, compared with the national average response time of 7 minutes and 45 seconds for a house fire. Fortunately, sprinklers and mist systems provide an instant water supply, significantly reducing fatalities and fire damage.

For decades, fire suppression systems have added a critical layer of protection on top of “passive” fire protections such as fire doors, firestopping and other compartmentation methods.

While regulations now require these systems in many new homes, there is currently no requirement for any existing residential buildings built before 2007 to retrofit potentially life-saving fire sprinklers or water mist systems.

In June 2023, Inside Housing magazine surveyed 37 large social housing providers in England and found that out of 1,768 higher-risk buildings (HRBs) they own, only 334 (18.9%) had been fitted with sprinklers, and more than half of those were fitted in one local authority (Birmingham). Among the rest, just 8.6% of blocks had been retrofitted with sprinklers.



“It is recommended that your department encourages providers of housing in high-rise residential buildings containing multiple domestic premises to consider the retrofitting of sprinkler systems.”

Coroner’s statement following the Lakanal House fire, London, 2009



Although no new regulations stipulate the installation of automatic fire suppression systems into existing HRBs, the Building Safety Act requires risk assessments.

As a result, many building owners have already decided that installing sprinklers or water mist systems can reduce some of the risks related to a potential fire outbreak.

In some cases, residents have petitioned landlords to fit fire suppression systems. For instance, a housing association in Salford retrofitted sprinklers after receiving more than 100 calls from worried residents post-Grenfell.

However, not all residents welcome sprinkler or water mist systems with open arms. Some of the early pilots attracted complaints about the aesthetics of retrofitted systems due to ugly trunking. Misconceptions about the water damage caused by these systems, cost, disruption during installation and need for regular maintenance are also among the reasons listed by residents opposing these systems.

In mixed-tenure blocks, landlords face the additional challenge of convincing those who have bought their flats to agree to fitting sprinklers because of the cost and the need for annual maintenance interventions. Depending on leasehold terms, it may also be difficult to gain access to some of the flats or recover the cost of fitting the systems from private owners.

However, anecdotal evidence suggests that most people welcome installing a sprinkler or water mist system because it makes them feel safer.



Housing 21

Retrofit sprinklers in high-rise buildings — and low-rise, too

Housing 21 is a registered social landlord that provides housing and care for people over 55.

Having checked that none of its six buildings over six storeys had cladding issues immediately after Grenfell, Housing 21 commenced a programme to retrofit sprinkler systems. It also conducted a series of Type 4 fire risk assessments.

The assessment revealed that a two-storey building had four flats that shared a fire compartment with the stairs, which could have hindered people's ability to escape in the event of a fire. Housing 21 also undertook firestopping works in some buildings, such as changing fire doors and compartmentation work within risers.

Nottingham City Homes

Joining forces to go above and beyond

Following fire safety audits of its high-rise blocks in 2017, Nottingham City Homes decided to install sprinklers in all corridors and communal areas within its tower blocks, and by March 2018, the work started.

In June 2021, Nottingham City Homes reported that sprinklers had been installed in flats and communal areas of 13 high-rise blocks. It had funded these works and some works on lower-rise buildings to the tune of £8.5 million (GBP).

In 2019, Nottinghamshire City Council set up the country's first joint audit and inspection team to look at all the city's at-risk buildings. The team inspected 484 buildings in total, looking at high-rise residential buildings and any building with 11 or more flats.

Birmingham City Council

A risk-based approach

In June 2017, Birmingham City Council said it would fit sprinkler systems in all of its 213 high-rise buildings. It took a risk-based approach to scheduling the work over a three-year programme that began in late 2018.

In the first year, sprinklers were installed in sheltered high-rise blocks and blocks where works were already underway. In the second year, systems went into blocks with 14 storeys or more and blocks between 10 and 14 storeys with only one staircase. The final year saw sprinkler systems installed into blocks of 10 to 14 storeys with double staircases and blocks under 10 storeys.

As of April 2023, 14 fires and 14 successful sprinkler activations had occurred.



The Guinness Partnership

A tall order for Guinness

The Guinness Partnership pledged to install sprinklers in all its buildings taller than 18 metres, all timber-frame buildings taller than 12 metres and blocks that are home to less mobile residents. The housing association owns around 65,000 homes, including 40 high-rise blocks and more than 380 medium-rise and complex buildings.

The Guinness Partnership's sprinkler retrofit programme began in 2020, with the association stating in its 2020/21 annual report that systems were fitted in 13 high-rise blocks, and in the 2021/22 report that they were fitted to nine more blocks. Sprinklers were installed in individual homes, work on dry risers was completed, and other safety improvement measures were completed there and in a Grade II listed building in Manchester city centre.

Arcon Housing Association

Residents sleep easier

The board of the Arcon Housing Association decided to retrofit a sprinkler system into its sole high-rise building, in Greater Manchester, just one week after the Grenfell fire. By December 2017, the works were complete.

The housing association's contractor first installed sprinklers in the ground-floor office so that residents could see what the system would look like. With the 25 residents on board, the project, which saw four sprinklers installed in each of the flats, took just over six weeks. One resident said, "I think Arcon are on the ball doing this. They've not waited to be told that they have to have it done. I do feel a lot safer ... I go to bed easier."

Maintaining fire suppression systems

The need to maintain fire suppression systems and regularly test them for operating characteristics that have been in service for several years is widely understood in the U.S. but less common in the U.K.

While it is critical that systems are properly designed and installed, it is equally vital for them to be periodically inspected, tested and maintained to help ensure that the equipment will perform as intended when a fire occurs.

While certain types of sprinklers may not need testing or replacement for 50 years, other types, like those typically installed in residential facilities, should be tested or replaced after 20 years or even sooner.

The [FPA](#) confirms that annual sprinkler and water mist system inspections are critical. These inspections should be undertaken by an independent third party (not the system owner, building occupier, system installer or maintenance provider). It also advises that a sample number of sprinklers should be removed and tested by an independent, third-party testing laboratory at least every 25 years.

A well-organised maintenance and testing regime of this sort is recommended for all high-rise residential buildings. Building owners and registered social landlords can then review the results and make better-informed decisions about the life span of their fire suppression systems.



UL Solutions — inspiring confidence

UL Solutions has been certifying and listing fire sprinklers since 1902, and our engineers have conducted hundreds of investigations of residential sprinklers. We are well-positioned to support registered social landlords, other building owners and the fire suppression industry as properties are safely retrofitted.

Our services support building owners and the fire suppression industry's need for reliable, accurate test results and certifications. UL Solutions' certification and testing services evaluate the ability of fire suppression systems to comply with the applicable standards, such as EN 12259-14. The third-party evaluation of these products in accordance with nationally recognised standards is an essential element of the fire suppression industry's overall safety scheme.

For several decades, UL Solutions has also examined and tested sprinklers sampled from field installations according to the recommendations and requirements of applicable NFPA standards in the U.S. Consequently, over the years, several new and revised requirements have been adopted into UL Standards intended to enhance sprinklers' general operating performance in field environments.

Our service for testing sprinklers sampled from systems is a valuable tool to assist property owners, inspection authorities, the insurance industry and others in making important assessments of the operating characteristics of sprinklers in existing facilities.

UL provides expert testing and certification of sprinklers to check the operating performance of both wet- and dry-type sprinklers in residential, commercial and industrial settings.

UL tests sprinklers sampled from field installations as a service to inspection authorities, the sprinkler industry, the insurance industry, and property owners.

UL Product iQ[®] allows you to quickly locate the product or component that will meet your needs, even without the exact certification number.



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