

Sprinklers

All of us have heard of sprinklers but are you aware professionally of the gains they offer in architectural design freedom? Did you know that sprinklers can save your client money? The Business Sprinkler Alliance, BSA, was set up to inform the business and construction sectors of the benefits of sprinklers, so that business owners and building designers can make informed decisions about their use.

Unfortunately, the sprinkler world is battling against prejudice. This is because when sprinklers are shown on television or in films, dramatic effect insists that they all go off together and cause mayhem. In fact, of course, nobody would buy a system that works like that. Instead, each sprinkler is held closed by a small glass bulb containing a liquid which expands as it gets hot. At a set temperature, usually 68°C, there is no more room for the liquid to expand, the glass bulb shatters and the sprinkler seal is released. Each sprinkler operates individually and in most fires only one or two operate, spraying much less water than a single fire hose. Since the sprinkler system starts to spray water on the fire well before the fire brigade arrives, fire damage is reduced by over 80%. Water damage is also much less significant and best of all, fire deaths are very rare.

In England and Wales¹ to comply with regulations for new buildings most designs follow the guidance in Approved Document B, (AD-B). However, as this makes clear, "there is no obligation to adopt any particular solution contained in an Approved Document if you prefer to meet the relevant requirement in some other way." In fact AD-B itself frequently offers more than one approach, a number of which are shown in its Table A2. For example, while AD-B requires sprinklers in offices and flats higher than 30m, for offices between 5m and 30m in height and for single storey shops, assembly and recreation buildings, factories and warehouses it offers a 30 minute reduction in required fire resistance. Table 12 in AD-B limits the floor area of any one storey in a shop or shopping centre to 2,000 m² but does not impose a limit with sprinklers. AD-B calls for care homes to fit self-closing devices on each bedroom door but they need not be fitted if a sprinkler system is provided.

AD-B also has some incentives for the use of sprinklers in houses. In a four-storey house a sprinkler system may be fitted as an alternative to a second, protected staircase. More commonly, where a loft in a two-storey house is converted into an additional storey the staircase may end in an open plan ground floor if sprinklers are fitted there. Otherwise the staircase must run in a corridor to the front door.

1) Scotland's building standards differ and in fact more buildings are required to be sprinklered there. Northern Ireland also has its own regulations and codes.

Space is at a premium in our cities. If buildings are fitted with sprinklers AD-B allows them to be built closer together, halving the minimum distances between buildings because the risk of fire spreading from one to another is greatly reduced.

AD-B does not cover schools. Instead, BB 100 gives government fire safety design guidance for schools. BB 100 makes clear that there is an expectation that most new schools will be sprinklered. One design gain with sprinklers is the raising of the fire compartment area limit from 800m² to 2,000m² in multi-storey schools and to an unlimited area in single storey schools. Schools have proven to be particularly vulnerable to fire with insurance losses above £50 million each year. Consequently, insurers generally offer far better terms for sprinklered schools.

BS 9999 was published in 2008 and is likely to begin a revision cycle this year. BS 9999 assigns risk profiles to buildings depending on who is in them and the likely rate of fire growth. It then sets out guidance much like in AD-B but introduces flexibility if certain measures are strengthened. If sprinklers are fitted, the rate of fire growth is assumed to be one category slower. Using the tables, this allows longer travel distances and narrower escape routes. It could mean a building needs two staircases instead of three, a saving which would more than pay for the sprinkler system. As in AD-B, if sprinklers are fitted the required fire resistance is often 30 minutes less. While BS 9999 does not have the same standing as the statutory guidance of AD-B, government representatives attended every committee meeting to draft the standard and did not raise any objections to the current text.

In December 2011 BS 9991 was published. This standard covers residential buildings and complements BS 9999. Like BS 9999, it contains many design freedoms for sprinklers. Based on research by the Building Research Establishment conducted for the NHBC, it permits open plan flat design, so that the front door opens into a living area beyond which are the bedrooms. AD-B does not allow this layout because if a fire starts in the living room, anyone in the bedroom would have to go through that room to escape. The BRE research showed that with enhanced detection and a sprinkler system, a higher level of safety is afforded in an open-plan flat than in an unsprinklered flat with a protected corridor. Many people like the open-plan layout, which gives a view and natural light from the front door while turning the corridor into liveable space. Outside the flat, BS 9991 permits longer common corridors if sprinklers are fitted, again potentially saving a staircase. It also accepts reduced fire brigade access, which can be helpful if a building plot is behind other buildings or the access road is narrow. As with BS 9999, government officials attended every meeting during the drafting process.

The relaxations in traditional building layout and compartmentation given in BS 9999 and BS 9991 are relatively modest. The BSI committee which wrote them was cautious since the standards could be applied to a wide variety of designs. Greater flexibility is often possible with a fully fire-engineered design. While the sprinkler system will be the same, the fire engineer will show for the design of the specific building that it is safe and reasonable to extend travel distances further, or to have multi-storey compartments. When heritage buildings become hotels or public buildings sprinklers are often preferred to the traditional solution of additional compartmentation which, as the official guidance in Scotland makes clear, causes greater damage to the historic fabric.

But what about the cost? A government study of about 60 schools found that sprinklers typically represent 2% of the cost of a building. However, as described above, they can frequently be used to reduce other costs so that the net cost effect may be neutral or better while the architect is able to design the building with fewer restrictions in layout. Cost benefit analyses have already shown an economic case for fitting sprinklers in schools, flats and care homes. Later this year the BSA expects to publish the results of cost-benefit analyses it has commissioned on warehouses and factories. The BSA has already published a report on the environmental impact of warehouse and factory fires, showing that sprinklers could save huge amounts of fire-fighting water and reduce the average lifetime carbon emissions from these buildings.

This is a quick summary of the potential benefits sprinklers offer to architectural technologists. The BSA plans to offer free sprinkler training courses to CIAT members.

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Chartered Institute of Architectural Technologists
397 City Road, London, EC1V 1NH
T: +44 (0) 207 278 2206
E: practice@ciat.org.uk