

British Automatic Fire Sprinkler Association
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INFORMATION FILE

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Water Storage Tanks for Sprinkler Systems



A guide to the purpose of and the different types of water storage tanks used for fire sprinkler systems



WATER TANKS FOR SPRINKLER SYSTEMS

Automatic fire sprinkler systems are installed for two main reasons, either for property protection or life safety. In either case their efficiency in controlling and extinguishing fires has for over one hundred and twenty years protected lives and the environment and it should be accepted that all sprinkler systems will protect lives by restricting fire spread and protecting escape routes.

Property protection systems are often installed at the request of the building occupier's insurer to protect the business by ensuring the building and contents are protected against fire.

Some systems are installed to comply with building or fire regulations primarily to protect employees, the public and fire fighters from the risks of fire. This type of system should be more accurately referred to as 'enhanced availability' sprinkler systems but are more commonly called 'life safety'sprinkler systems include a range of added features which reduce the possibility that the system will ever be non operational due to scheduled service and maintenance being carried out.

In both of these cases an essential part of the system is the water supply. This can take the form of a direct supply from the local water service main with or without a booster pump or, more reliably, having water stored in a tank with a pump or pumps to deliver the water to the sprinkler system.

The most common arrangement is a single water storage tank with two fire pumps, each capable of meeting the needs of the sprinkler system.

For enhanced reliability, the water storage tank can be split into two half-capacity tanks. This ensures that there is always a water supply available to the sprinkler system, even when one tank (or any of its equipment) is being serviced or maintained.

STANDARD OF CONSTRUCTION FOR SPRINKLER TANKS

It is essential that the water storage tank is of robust construction and is designed and constructed to need little maintenance or servicing. Sprinkler water storage tanks are built to a high standard that will provide a 10-year service life a requirement for LPCB listing for tanks for systems which require a Superior Water Supply without there being any need for drainage and cleaning.

A list of LPCB-approved tanks can be found in the LPCB 'Red Book' and on their website. These tanks come in sizes from 5m³ up to 1300m³ depending on the hazard category of the sprinkler system. If a larger capacity is required a combination of approved tanks can be used.

The relevant sections of the LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845: 2009 that apply to water storage tanks for sprinklers are:

- TB 203 Care and maintenance of automatic sprinkler systems
- TB 204 Sprinkler system grading
- TB 209 ESFR sprinkler protection
- TB 218 Water supply diagrams
- TB 221 Sprinkler in schools
- TB 224 Water storage tanks (cisterns)
- TB 229 Variations to BS EN 12845 rules
- TB 233 Water supplies for life safety systems

Sprinkler tanks are also listed by the US insurers' certification body UL and by the industrial insurer FM Global for use on specified sites. For contracts designed to NFPA 13 (US National Fire Protection Association Codes) either an FM or LPCB listed tank can be used subject to insurers' approval.

- **Water can be supplied directly from the mains or stored in a tank.**
- **Booster pumps can be used to increase water pressure where required.**
- **The most common arrangement uses one storage tank and two fire pumps.**
- **Each fire pump is capable of meeting the sprinkler system's water demand.**
- **For greater reliability, two half-capacity tanks can maintain supply during maintenance or servicing.**
- **Sprinkler tanks are built to robust standards, with a 10-year service life and minimal maintenance requirements.**

TYPES OF TANKS USED TO STORE WATER



Cylindrical Galvanised Steel or Aluminium Tanks
This type of water storage tank is the most common type used for sprinkler systems. Construction is by galvanized steel or aluminium sheets that are bolted together to form a cylinder. A mastic seal is applied between each metal sheet or a butyl rubber PVC or EDPM liner is fitted. These tanks are usually installed close to the protected premises on a prepared concrete base or occasionally inside the protected premises. This picture shows the access ladder, ball valve housing and tank infill pipe.

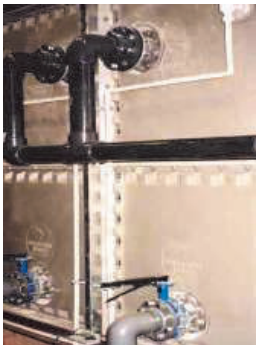


Galvanised Pressed Steel Panel Tanks
These tanks are constructed using square steel panels that are bolted together to form a cube shape to suit the space available. They can be installed inside or outside the premises.

Profiled Galvanised Steel Panel Tanks
The panels for this type of tank are curved and individually bolted to upright stanchions. They can be installed inside or outside the premises.



Moulded GRP Panel Tanks



These tanks are formed by bolting together square GRP panels to form a cube to suit the space available. They can be installed inside or outside the premises. This picture shows the service main infill to the two ball valves (black pipes), two grey drain pipes and a water level switch (white pipe)

Corrugated Galvanized Steel Panel Tanks
The panels are bolted together to form a cube shape to suit the space available. They can be installed inside or outside the premises.



Gravity Tanks
Can be any of the above tanks installed high up in a tall building, on a hill or on a separate high level platform. Depending on the tank's elevation, the 'static' pressure or 'head' can sometimes be sufficient to supply the needs of the sprinkler system.

Pressure Tanks
This is a cylindrical steel pressure vessel which is filled to two thirds capacity with water and one third with air under pressure. In the event of a fire the pressurised air expels the water and delivers it to the sprinkler system. This type of water supply can be found on older sprinkler installations and is no longer commonly installed on new sprinkler systems.

Concrete tanks
On sites where there is insufficient space above ground or because of planning restrictions an underground tank can be constructed from concrete. The standard for the construction of such tanks is BS 8007.

Retrofit Concrete Tanks
Where a concrete structure that will bear the load of the stored water exists on a site, it may be possible to provide a fire sprinkler water storage tank in a retro-fit situation. The concrete structure can be lined with a butyl rubber or EDPM internal membrane similar to that used in steel tanks. The lining material can be either pre-fabricated and taken to site in one piece and installed, or fabricated on site to suit a particular tank, through specialist hot vulcanising or welding techniques.

Single-piece GRP Underground Tanks
These are a single piece domed end cylindrical tanks which is installed below ground, strapped to a concrete base or with a concrete surround. At present, there are no tanks of this type listed by the LPCB.

Other Acceptable Sources of Water
Provided adequate capacity exists, swimming pools, lakes, canals and rivers can be used as the water source for a sprinkler system provided the supply and availability is guaranteed. Because these sources may contain foreign matter in suspension it is necessary to fit a strainer (and sometimes filters) to minimise the risk of clogging pumps and the sprinkler pipes.

Positive Head or Suction Lift
Section 10.6 of BS EN 12845:2009 requires the following (see also LPC Rules TB 210:2008):-

Wherever possible, horizontal centrifugal pumps shall be used, installed with a positive suction head. i.e. in accordance with the following:

- at least two thirds of the effective capacity of the suction tank shall be above the level of the pump centre line;
- the pump centre line shall be no more than 2 m above the low water level of the suction tank.

If this is not feasible, the pump may be installed under suction lift conditions or vertical turbine pumps may be used.

Note: Suction lift and submersible pump arrangements should be avoided and only used when it is not practicable to arrange positive suction head.

Underground Tanks and Pump Houses
Underground tanks or pump houses may sometimes be the only option but these are subject to some constraints and problems may occur in respect of dampness as well as issues of access. It is strongly advised that the insurers' views be sought before proceeding with such an installation. There is useful information on working in confined spaces in Part 3 (Supplementary Information) of the LPC Rules.

CORROSION PROTECTION OF STEEL TANKS

The 'weight' of galvanized coating on steel panels and sheets used in the construction of superior quality sprinkler tanks can be up to 610 g/m² on both sides of the tank wall. An alternative corrosion protection system which has been specifically approved and listed by the LPCB can be used. In the LPCB listings of approved equipment, these tanks will have either a 'g' or 'e' respectively in their Approval number i.e. 123c/06g or 123c/02e

LPCB APPROVED TANK INFORMATION PLATE

All LPCB listed tanks must bear a plate stating:

- The name and address of the manufacturer.
- The date of installation.

- The LPCB Reference Number, including the type suffix ("Superior" or "Single") which has been specified by the purchaser and agreed by the manufacturer.
- The maximum capacity in cubic metres.
- Multi-supply tanks must indicate the capacity for the automatic sprinkler system separately.

WATER QUALITY

The preferred source of water to supply the sprinkler tank is from the utility company's service mains as it is clean and free from any extraneous matter that could cause clogging of the sprinkler pipes.

HOW MUCH WATER IS NEEDED?

This depends on the hazard classification of the sprinkler system and the sprinkler rules used. Usually the greater the hazard the larger the volume of water required to control or extinguish the fire. The duration of water application also increases with the hazard.

WHAT AFFECTS THE AMOUNT OF WATER REQUIRED?

- The sprinkler design standard being used.
- Hazard classification and design density.
- Type of system, wet or dry pipe.
- Height of the highest sprinkler above the lowest sprinkler.
- Duration of water supply.
- Whether the tank is a Full holding or Reduced capacity.
- The capability of towns main to fill the tank in an acceptable time (36 hours for BS EN 12845)

FULL HOLDING OR REDUCED CAPACITY?

A tank is classified as 'full holding capacity' when all the water necessary for the sprinkler system is stored on site. For example an Ordinary Hazard 15m (OH3 15m) wet-type sprinkler system would have a 135 m^3 tank.

A 'reduced capacity' tank for the same hazard could be as small as 30 m^3 provided the inflow from the service mains could make up the shortfall of 105 m^3 in 60 minutes.

WHAT DURATION OF WATER SHOULD BE PROVIDED?

BS EN 12845 Light Hazard	30 minutes
BS EN 12845 Ordinary Hazard	60 minutes
BS EN 12845 High Hazard	90 minutes
BS 9251 Residential	30 minutes
BS 9251 Domestic	10 minutes
Schools (TB221) OH1	30 minutes
Schools (TB221) OH2+3	60 minutes
FM/NFPA varies from	30 to 240 minutes

TANK SUPPORT BASE

The support base for the sprinkler tank will vary depending on the type of tank installed. The most common types are circular or rectangular concrete bases, low level concrete walls or steel beams. When the tank is ordered, the tank manufacturer will issue detailed drawings of the type of base required for their particular tank. These plans must be strictly adhered to and should not be modified without written permission from the manufacturer.

TANK PAINTING

The external surface of the tank can be painted to choice by the client but the tank manufacturers should be consulted to ensure that any coating used does not damage the tank wall and does not invalidate the LPCB listing and any manufacturers' warranty.

TANK LOCATION

Whenever possible the sprinkler tank should be located within 5m of the sprinkler pump house.

Careful consideration must be given to the location of the sprinkler tank, areas to be avoided are:

- Near trees where roots could damage the tank base.
- In areas where water can accumulate near the tank base and accelerate corrosion or in time undermine the tank base.
- Near pipes or underground services where the weight of the tank may damage them. For every metre of tank height the weight of water on the ground will be 1 tonne per square metre.
- Near hot or corrosive exhaust extracts/pipes where the tanks protective coating could be damaged.

PLANNING APPROVAL

During the planning stage drawings and details of the location of external sprinkler tanks should be submitted to the local planning authority for their approval.

INSURERS APPROVAL

All drawings and details of the sprinkler system, pumps and tanks should be submitted to the insurer for their approval and comment before the installation takes place.

TANK ACCESSORIES

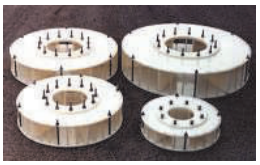
For optimum functionality, the following accessories will usually be installed on the tank/s:

- A reliable water supply connection (usually direct from the service main) capable of refilling a full holding capacity tank in 36 hours or with sufficient flow to replenish a reduced capacity tank in 30, 60 or 90 minutes as necessary.
- Reduced capacity tanks will have a flow testing facility to prove the flow rate of the infill. Adequate drainage should be provided for disposal of water during testing.
- Float or Ball valve/s on the tank infill pipe. These must be located in a secure housing on the tank roof.
- An duel element electric immersion heater to prevent ice forming on the water surface in the area of the ball/float valves.
- Electric float switches to transmit signals to the BMS or fire control panels to indicate the volume of water in the tank.
- A drain valve at low level.
- A ladder to allow personnel to get to the inspection and maintenance platform on the tank roof. For security reasons the lower section (about 2m long) of the ladder can be easily removed and stored for future use.
- A pump suction pipe with an electrically monitored gate valve, locked open.
- A rigid roof that excludes daylight, can withstand snow loads and prevents any matter falling into and contaminating the water.
- Safety rails to all platforms.
- Most tanks have a vortex inhibitor fitted at the inlet of the pump suction pipe to prevent air getting drawn into the pump. For LPCB approved tanks the vortex inhibitor must be an approved type. For NFPA and FM Global contracts the vortex inhibitor must be constructed as detailed in their data sheets.
- Trace heating and lagging to all exposed water filled pipes.
- A 25mm warning pipe is installed just above the high water level to give an early warning of ball valve malfunction.
- A 'spill over' slot at the ball valve level to prevent back contamination of the water supply mains.
- A larger bore overflow pipe
- An access hatch is provided at ground level to allow accesses during tank construction and evacuate personnel in an emergency.
- A contents gauge or device which shows the level of water in the tank.
- Some sprinkler tanks will have a fire brigade inlet installed. This allows the brigade to 'top up' the sprinkler water storage if necessary.
- A sump can be formed in the concrete tank base. This allows the sprinkler pump to draw water to a lower level from the tank.

BALL FLOAT VALVE

These are installed at the end of the incoming water supply pipe and automatically keep the tank full.

ANTI-VORTEX PLATES



These are installed on the suction pipe inside the tank to stop a water vortex forming and air being drawn into the pump.



Typical sprinkler water supply with two tanks.



Typical sprinkler water supply with a single tank.

REFERENCE PUBLICATIONS

- LPCB Red Book: List of Approved Fire and Security Products and Services
- LPS1276 Issue 1.1: Requirements for the LPCB Certification and listing of above ground suction tanks for sprinkler systems.
- WIS4-25-01:Water Industry Specification for the use of steel tanks in the water industry.
- BS4211:Ladders for Permanent Access
- BS5493:Protective coating of iron and steel structure against corrosion.
- BS8007:Code of practice for the design of concrete structures for retaining aqueous liquids.
- BS EN ISO 12944:Paints and varnishes – Corrosion protection of steel structures by protective paint systems.
- LPC Rules for Automatic Sprinkler Installations: Incorporating BS EN 12845 Fixed fire fighting systems – Automatic Sprinkler systems – Design, installation and maintenance.
- BS9251: Sprinkler systems for residential and Domestic occupancies : Code of practice.
- LPCB Scheme Document SD037: Suction tanks for fire pumps for automatic sprinkler pumps.
- FM Global Data sheets.
- National Fire Protection Association Standards.

PRESENTED BY

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