Association of Irish Risk Management
An Introduction to Sprinklers
12th September 2012

Introduction

- Welcome
- Presenters
- National Sprinkler Company

Agenda

- The development of sprinkler protection – an historical perspective
- Principles of design – tailoring the installation to the risk
- Sprinkler heads – types, uses and sensitivity
- Codes, standards & regulations
- 11.00am Coffee break (30 mins)
- Water supplies
- Control of design, installation and maintenance
- Types of system and alarm valves
- Protection of storage
- Sprinklers, life safety and the building regulations
- Questions & answers (10 mins)

What is a sprinkler system?

- An Automatic Fire Sprinkler System can be defined as “A system designed to discharge water under pressure from sprinkler heads at or near the point of origin of a fire only”.

- It is designed to control a fire until the fire brigade can respond.

- They were originally developed for the protection of the property or equipment, however in recent years they have been used for the purposes of life safety as an aid to the means of escape of personnel

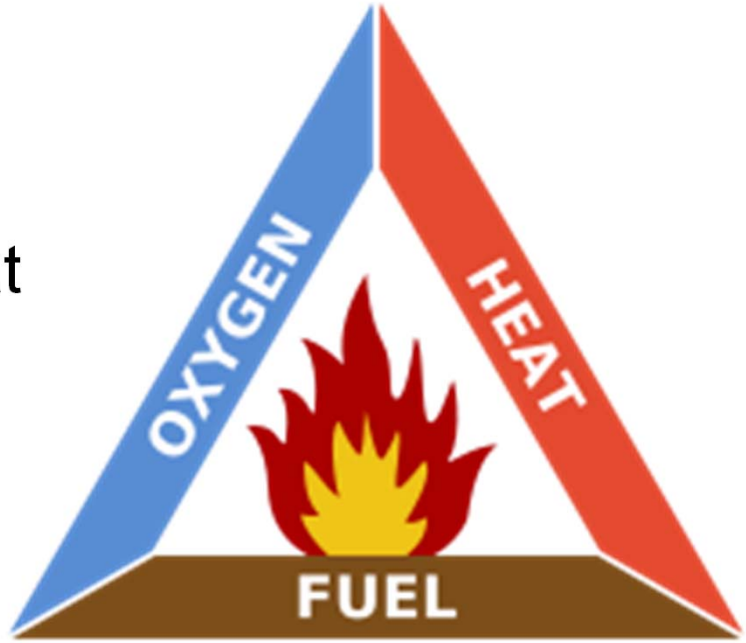
Sprinkler System is Multifunctional

A sprinkler system is:

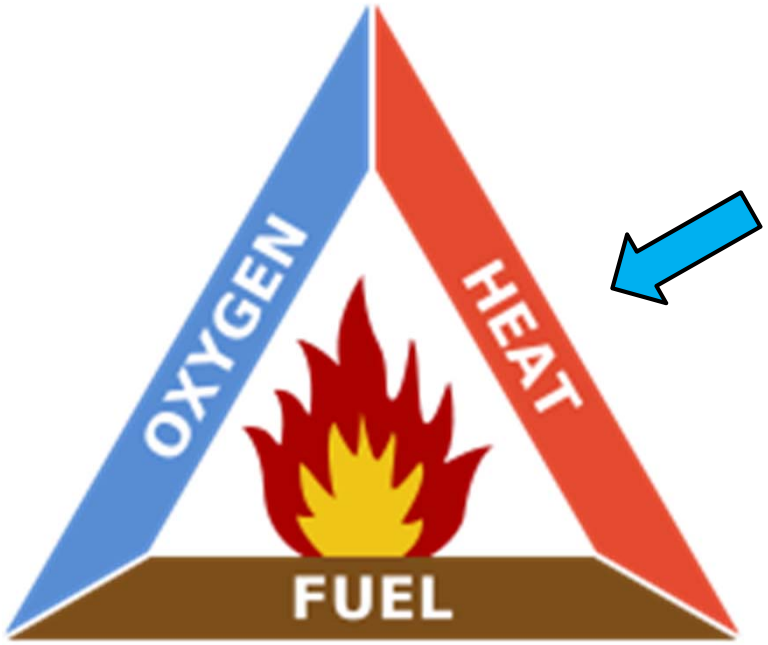
- A fire detection system
- A fire alarm system
- A fire suppression system

What do we need to start a fire?

- We need fuel
- We need oxygen
- We need heat
- These are the 3 elements that make up the fire triangle



The Fire Triangle

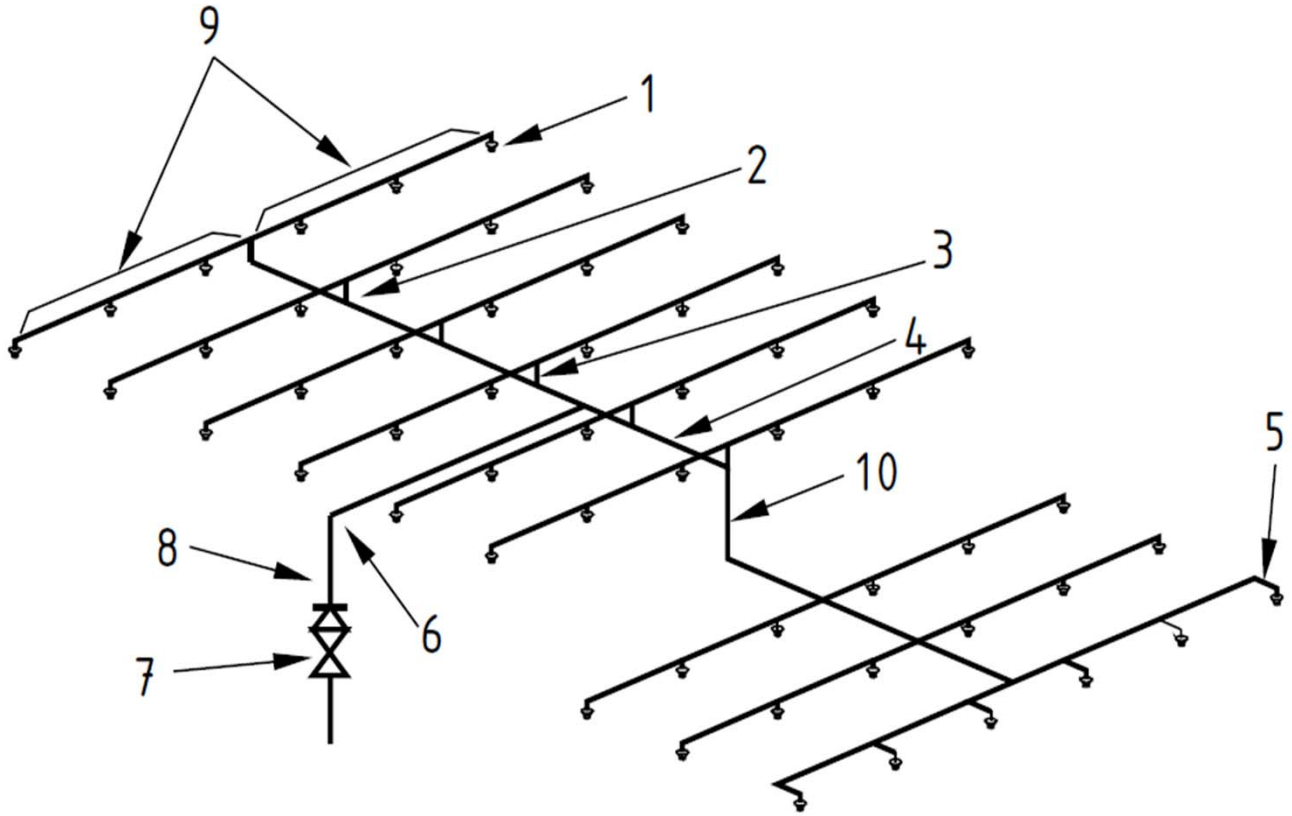


A sprinkler system reduces the level of heat

Major parts of a sprinkler system

- Water supply – typically fire pumps & a water tank
- One or more sprinkler installations. Each installation consists of a set of main installation control valves.
- A pipe array fitted with sprinkler heads.
- Sprinkler heads are fitted at specified locations at the roof or ceiling, and where necessary below obstructions, in storage racks/shelves, or in and around plant and equipment

The main elements of a typical installation



Key

1 Sprinkler head
2 Riser
3 Design point
4 Distribution pipe spur
5 Arm pipe
6 Main distribution pipe
7 Control valve set
8 Riser
9 Range pipes
10 Drop

Water Storage Tank

Sprinkler Pumphouse

Sprinkler Pumphouse

Sprinkler Pumphouse

Sprinkler Pumphouse Enclosure

Sprinkler Valve Set

Sprinkler Protection

Myths & Facts

- Sprinkler systems have been proven in use for well over 100 years, during which time they have a 99% success rate worldwide. Systems over 100 years old are still in full working condition today.
- According to BASFA, except for explosions there has never been a fire death in a fully sprinklered building in the UK. The total number of deaths world-wide in sprinklered buildings is only 50 compared to thousands in unprotected buildings. This is a record no other fire system can match.
- Losses from fires in buildings protected with sprinklers are estimated to be only one tenth of those in unprotected buildings.
- It is untrue that all the sprinklers operate when fire breaks out. In 60% of cases fires are controlled by the spray from 4 sprinklers or less.

Myths & Facts (cont'd)

- Reports of water damage caused by sprinklers are often exaggerated. Firemen often use more than10 times more water from hoses to do the same job as a sprinkler. In tackling the Windsor Castle fire, 7 million litres of water were used.
- Sprinklers are very stable and do not operate spuriously. Worldwide records show that only 1 in 16 million sprinklers installed per year will result in failure. Every single sprinkler head is independently tested before leaving the manufacturing plant.
- The cost of installing a sprinkler system (excluding water supply) is roughly equivalent to carpeting the same building. All the UK Royal Palaces could have sprinklers installed for the cost of the Windsor Castle fire.

Why are sprinkler systems installed?

Because of their proven effectiveness over many years.

Their value is appreciated by the following organisations:

- Insurance companies
- Local fire safety officers
- Architects
- Building control
- Some building owners

In the UK, BAFSA (British Automatic Fire Sprinkler Association) reported that over a 12 year period, the number of fires in sprinklered buildings was 16,800. Almost half of these were controlled by one or two sprinklers.

Sprinkler system benefits

- Protection 24 hrs a day x 365 days a year
- In some high risk categories, facilitates insurance cover
- Can provide a construction "trade off', in respect of compartmentation.
- Provide substantial revenue spending economies, by reducing insurance premiums.
- Corporate taxation concessions; qualifies as "Plant & Machinery" against tax.

System failures

- System turned off in error.
- Inadequate water supply.
- Hazard of occupancy - i.e. Occupancy does not match level of protection provided.
- Poor or inadequate maintenance.
- Changes in building layout - i.e. protection not updated.
- Exposure risks from unsprinklered buildings.
- System frozen - heating failures.

Summary

A properly designed, installed and maintained system:

- Saves lives
- Saves property
- Saves the business

It is there 24 hours a day, 365 days per year to fight a fire effectively whenever that fire occurs. As the sprinkler operation is only local to the fire area, water damage is minimised.

There is no other, more effective means of fighting a fire and, with the correct level of service and maintenance; the chances of it letting you down are almost negligible.

Principles of design – tailoring the installation to the risk

<u>The most important element in the entire process of providing a sprinkler system is ensuring that the proposed sprinkler system is sufficient to protect the risk involved.</u>

We must establish:-

- The proposed use of the building i.e. the occupancy office, production, storage etc.
- Is there any storage? If so, what category of goods does the stored product fall into, what is the method of storage, and what height are the goods stored to?
- If the area is used for production, what are the fire risks associated with the production process?

Hazard Class

The hazard class to which the sprinkler system is to be designed should be determined before the design work commences.

Buildings and areas to be protected by the automatic sprinkler system shall be classified as:-

- Light Hazard
- Ordinary Hazard
- High Hazard

This classification depends on the occupancy and the fire load.

Examples of occupancies are given in annex A of the LPC Rules for Automatic Sprinkler Installations incorporating BS EN 12845.

Light Hazard

Light Hazard Occupancies are occupancies with low fire loads and low combustibility and with no single compartment greater than 126 m² with a fire resistance of at least 30 min. Examples are:-

- Schools and other educational institutions
- Offices
- Prisons

Ordinary Hazard

Ordinary Hazard are occupancies where combustible materials with a medium fire load and medium combustibility are processed or manufactured.

Ordinary Hazard - OH, is sub-divided into 4 groups:

- OH1, Ordinary Hazard Group 1;
- OH2, Ordinary Hazard Group 2;
- OH3, Ordinary Hazard Group 3;
- OH4, Ordinary Hazard Group 4.

Ordinary Hazard examples

- OH1, Ordinary Hazard Group 1; Hospitals, Hotels Restaurants
- OH2, Ordinary Hazard Group 2; Car Parks, Museums, Dairies
- OH3, Ordinary Hazard Group 3; Department Stores, Shopping Centres, Furniture Showrooms
- OH4, Ordinary Hazard Group 4: Alcohol Distilleries, Concert Halls, Tobacco factories

High Hazard Process (HHP)

High Hazard, Process, covers occupancies where the materials concerned have a high fire load and high combustibility and are capable of developing a quickly spreading or intense fire.

HHP is sub-divided into four groups:

- HHP1, High Hazard Process Group 1;
- HHP2, High Hazard Process Group 2;
- HHP3, High Hazard Process Group 3;
- HHP4, High Hazard Process Group 4.

High Hazard Process (HHP) examples

- HHP1 High Hazard Process Group 1; Printing Works, Match manufacturers
- HHP2 High Hazard Process Group 2; Fire Lighter Manufacturer, Saw Mill
- HHP3 High Hazard Process Group 3; Cellulose Nitrate Manufacture, Rubber tires for cars and lorries
- HHP4 High Hazard Process Group 4; Firework Manufacture

High Hazard Storage (HHS)

High Hazard, Storage, covers the storage of goods where the height of storage exceeds the limits given in TB228.T1 of the LPC Rules.

High Hazard, Storage - HHS, is sub-divided into four categories:

- HHS1, High Hazard Storage Category I;
- HHS2, High Hazard Storage Category II;
- HHS3, High Hazard Storage Category III;
- HHS4, High Hazard Storage Category IV.

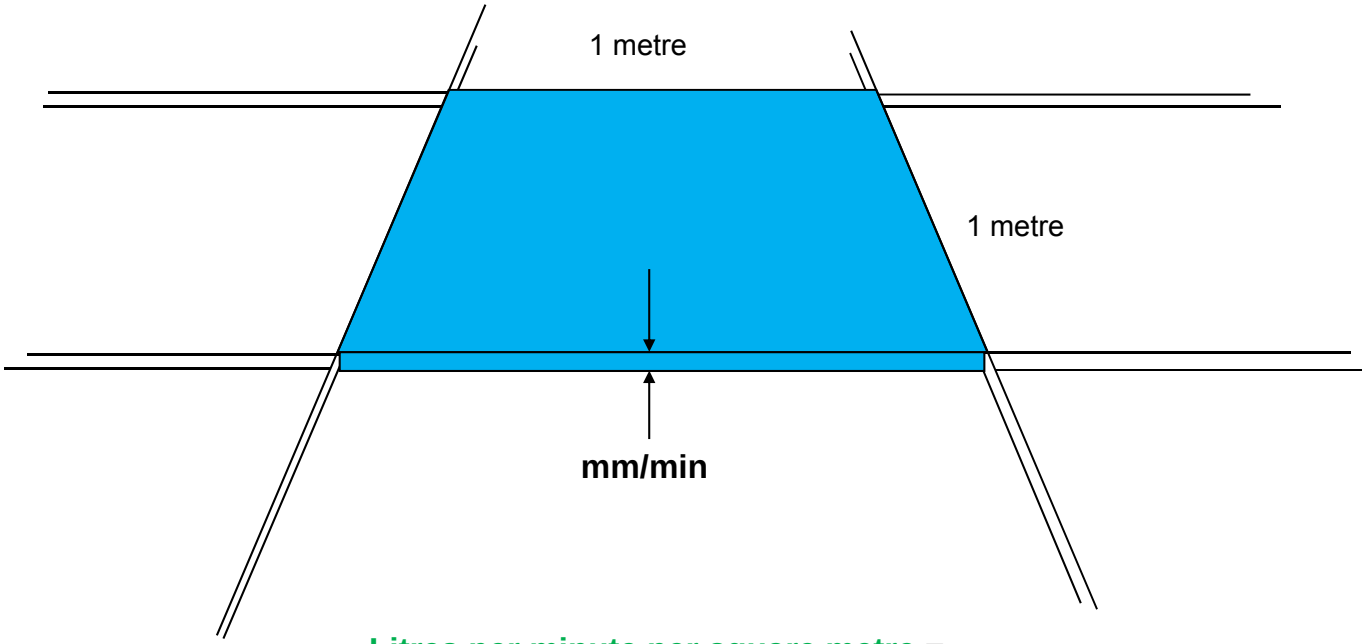
Hydraulic Design Criteria

- Once the extent of the risk involved is established we can then begin to look at the required hydraulic design criteria.
- Hydraulic design criteria is essentially the amount of water that will be required to be discharged in a fire scenario in order for the sprinkler system to control the spread of fire.
- The higher the risk, the greater the amount of water will be required in order to maintain control.

Design Density

- In the UK & Ireland we tend to measure the ‘amount’ of water in terms of system ‘Design Density’.
- Design Density is essentially a measure of the amount of water in millimetres (mm) per minute (min) required over a designated floor area in metres squared (m^2).
- This floor area is called the ‘Fire Area’ or ‘Area of Operation’ and is the area over which it is deemed in a worst case scenario that a fire could spread for a given hazard classification.

Design Density (cont'd)



Litres per minute per square metre =
millimetres depth per minute

Design Density example

For a risk classified as an OH 3 Hazard Class, the minimum 'Design Density' required to be discharged in the event of a fire is 5mm/min over an 'Area of Operation' of 216m^2 (assuming the system is a 'Wet' installation)

Table 3 — Design criteria for LH, OH and HHP

Hazard Class	Design Density mm/min	Area of Operation m^2	
		Wet or pre-action	Dry or alternate
LH	2,25	84	Not allowed Use OH1
OH1	5,0	72	90
OH2	5,0	144	180
OH3	5,0	216	270
OH4	5,0	360	Not allowed Use HHP1
HHP1	7,5	260	325
HHP2	10,0	260	325
HHP3	12,5	260	325
HHP4	deluge (see NOTE)		

NOTE Needs special consideration. Deluge systems are not covered by this standard.

Sprinkler heads – Types, uses and sensitivity

The sprinkler head is the key component in a sprinkler installation and is a unique product to the sprinkler industry. The current standard range consists of three deflector types:-

- Conventional
- Spray
- Sidewall

Upright

Pendent

Vertical Sidewall

Conventional

Conventional pattern head

- The conventional sprinkler arrangement is the most commonly used head in the UK & Ireland and has a universal deflector; it therefore can be used in both upright and pendant orientation.
- The conventional sprinkler is designed to discharge water above and below the deflector in almost equal quantities whether upright or pendant.
- It is considered acceptable for most applications.

Spray pattern head

- Spray heads are also acceptable in most applications but spray heads are designed to discharge most of the water (not less than 80% in a downward direction, different head designs are therefore employed for upright and pendant orientation).
- Spray heads cause no direct ceiling wetting although the generation of fine spray droplets, particularly at high water pressures, results in significant ceiling level cooling.
- Spray heads are less affected by ceiling mounted obstructions such as surface mounted lights fixed to false ceilings

Sidewall pattern head

- Sidewall sprinkler heads are used exclusively in light & ordinary hazard applications and are mainly used in narrow rooms or corridors.
- Usually located at the wall and discharge water across the room or corridor. Their location is not usually the ideal position from a detection point of view.
- Extended coverage horizontal sidewall sprinklers are often used in hotel bedrooms. Fire tests have demonstrated that the product is very efficient in this application.

Other sprinkler head variants

In addition to the 3 ‘standard’ type sprinklers there are also numerous other variants of sprinkler head available.

- Recessed and concealed pattern heads
- Ceiling pattern sprinklers
- Dry drop sprinklers
- Early Suppression Fast Response (ESFR) sprinklers
- Multiple Jet Controls (MJC’s)

Recessed and concealed pattern heads

- Both of these sprinkler types are essentially spray pattern heads.
- Usually limited to Ordinary Hazard Group 1 applications.
- Design is mainly governed by aesthetic considerations and in both designs the heat sensitive element is located above the ceiling line.
- Recessed and concealed sprinklers will always be less thermally responsive than equivalent standard products.

Ceiling pattern sprinklers

- Spray pattern type.
- Heavily influenced by aesthetic considerations. It is a low profile sprinkler, with the heat sensitive element just below the ceiling line.
- Most ceiling sprinklers have retracted deflectors which extend when the sprinkler opens.
- Their use is restricted to light and ordinary hazard occupancies.

Dry drop sprinklers

- Usually limited to pendent orientation sprinklers.
- Means of maintaining the drop (or riser), connecting the sprinkler to the range pipe, free of water.
- Particularly useful when sprinkler protecting risks such as cold stores. The range pipe may then be located outside the room or cabinet and the dry drop is inserted through a penetration in the insulation and ceiling.
- Also used where alternate or dry pipe installations are used to protect rooms with suspended ceilings.

Early Suppression Fast Response (ESFR) sprinklers

- ESFR sprinklers are quick acting high performance sprinklers which have the capability of suppressing fires within storage risks and thus negating the need for in-rack sprinklers.
- Particularly useful for areas of storage that are subject to constant relocation of goods throughout the building or areas with high levels of free standing storage.
- The design principles and the operating characteristics are significantly different from standard sprinkler protection. It is essential that all the necessary design and installation requirements are complied with, without exception, when applying ESFR protection.

Multiple Jet Controls (MJC’s)

- MJC's are small valves usually between 25 to 80mm which are operated by temperature sensitive devices, similar to sprinkler heads.
- Usually used in deluge applications.
- Are sometimes used as alarm devices in unsprinklered portions of sprinklered buildings. In these applications the water flow is discharged to waste.
- Can be used to detect fires in electrical switch rooms but rather than discharge water into the room they are piped to an open sprinkler located above the door at the entrance/ exit of the room.

Sprinkler temperature ratings

- Sprinklers shall be chosen with a temperature rating close to but no lower than 30^{o}C above the highest anticipated ambient temperature.
- In unventilated concealed spaces, under skylights or glass roofs etc., it may be necessary to install sprinklers with a higher operating temperature, up to 93^{o}C or 100^{o}C.
- Special consideration should be given to the rating of sprinklers in the vicinity of drying ovens, heaters and other equipment, which give off radiant heat.
- Under normal conditions in temperate climates a rating of 68^{o}C or 74^{o}C is suitable.
- Sprinklers are colour coded in accordance with EN 12259-1 to indicate their temperature rating

Sprinkler temperature ratings

Bulb	° C	Fusible link	ºC
orange	57	-	-
red	68	uncoloured	68/74
yellow	79	-	-
green	93	white	93/100
blue	141	blue	141
mauve	182	yellow	182
black	204/260	red	227

Sprinkler thermal sensitivity

- Response time index (RTI) is a measure of sprinkler thermal sensitivity.
- The thermal sensitivity testing method is considered unsuitable for rating the following sprinkler types and arrangements: recessed pattern; concealed pattern; sprinkler heads with protective coatings over the heat sensitive element. These sprinkler types and arrangements of sprinkler are classified as unrated.
- Sprinklers of different sensitivities shall be used in accordance with tables TB207.T3 and TB207.T4

TB207.T3

Table TB207.T3 Sprinkler sensitivity ratings	
Sprinkler pattern	**Sensitivity ratings**
Conventional Spray k160	Standard A or Special or Quick
Ceiling or flush Sidewall (upright or pendent)	Special or Quick
ESFR EPEC	Quick
Recessed Concealed Sidewall (horizontal)	Unrated[1]

Note 1: Recessed, horizontal sidewall and concealed heads are not designated a thermal sensitivity rating. The standard thermal sensitivity test is not appropriate due to at least one of the following reasons:

- the nature of the sprinkler assembly;
- orientation of the sprinkler frame when installed; or
- location of the temperature-sensitive element in relation to the roof or ceiling line.

The temperature-sensitive elements and their supporting components used in the construction of these sprinklers should operate in accordance with the special or quick response requirements, when tested in a conventional, spray or sidewall pattern sprinkler frame or suitable mounting assembly.

TB207.T4

Table TB207.T4 Sprinkler thermal sensitivity selection					
Sensitivity rating[1]	In-rack protection	Ceiling protection above in-rack	Dry systems and Pre-action Type A	ESFR and EPEC	All other
Standard 'A'	No	Yes[2]	Yes	No	Yes
Special	No	Yes[2]	Yes	No	Yes[3]
Quick	Yes	Yes	No[4]	Yes	Yes[3]

Note 1: When new sprinklers are added to an existing sprinkler installation, it may be necessary to take into account the effect of different sensitivities in order to prevent excessive activations.
Note 2: Where in-rack sprinklers are omitted from the top of the rack and greater reliance is placed on the ceiling protection, ceiling or roof sprinklers with a 'quick' rating should be used.
Note 3: Special and quick response sprinklers should not be used to protect ceiling plenums where sprinkler protection is employed, see TB223.6.
Note 4: Quick response EPEC sprinklers may be used in accordance with TB222 providing all of the requirements of dry-pipe systems are met.

Codes, standards & regulations

For sprinklers there are numerous Standards and Codes around the world but the vast majority are based on British or American originals. These are namely:

- The Fire Officers Committee (FOC) 29th Edition
- BS 5306 Part 2
- BS EN 12845
- NFPA 13
- Factory Mutual (FM)

As far as Building Regulations are concerned, the principal document is Approved Document B from the Building Regulations for England & Wales.

The LPC rules

- Additional insurers' requirements, and updates and amendments which could not be included in the British Standard, have been produced as LPC Technical Bulletins
- The combination of the new British Standard and the Technical Bulletins form ‘The LPC Rules for Automatic Sprinkler Installation incorporating BS EN 12845’

The LPC rules (cont'd)

- The British Standard and the Technical Bulletins have been written in the style of a practice specification whereby the users shall comply with all the requirements.
- Departure from the recommendations may be made at the user's discretion, but the insurers must be notified.
- Attention is drawn to the importance of selecting suitable sprinkler equipment and, whether for life safety or property protection, appointing suitably qualified contractors to undertake the design and installation.
- The LPC Rules make reference to a list of products and companies approved and certified by the Loss Prevention Certification Board. These can be found in the 'red book' (see http:///www.redbooklive.com)

Water Supplies

Water Supply Durations

Sprinkler system water supplies shall be capable of automatically furnishing at least the required pressure/ flow conditions of the system. Each water supply shall have sufficient capacity for the following minimum durations:

- LH 30 min
- OH 60 min
- HHP & HHS 90 min

Tank Capacity

For each system a minimum water volume is specified. This shall be supplied from one of the following:

- a full capacity tank, with an effective capacity at least equal to the specified water capacity;
- a reduced capacity tank, where the required water volume is supplied jointly by the effective capacity of the tank plus the automatic infill.

Full Capacity Tanks

Table 9 — Minimum water volume for pre-calculated LH and OH systems

Group	Height *h* of the highest sprinkler above the lowest sprinkler [A1] (see NOTE) [A1] m	Minimum water volume m^3
LH - (Wet or pre-action)	$h \leq 15$ $15 < h \leq 30$ $30 < h \leq 45$	9 10 11
OH1 - Wet or pre-action	$h \leq 15$ $15 < h \leq 30$ $30 < h \leq 45$	55 70 80
OH1 - Dry or alternate OH2 - Wet or pre-action	$h \leq 15$ $15 < h \leq 30$ $30 < h \leq 45$	105 125 140
OH2 - Dry or alternate OH3 - Wet or pre-action	$h \leq 15$ $15 < h \leq 30$ $30 < h \leq 45$	135 160 185
OH3 - Dry or alternate OH4 - Wet or pre-action	$h \leq 15$ $15 < h \leq 30$ $30 < h \leq 45$	160 185 200
OH4 - Dry or alternate	Use HH protection	

[A1] NOTE [A1] Excluding sprinklers in the sprinkler valve room.

Reduced Capacity Tanks

[A1] Table 11 — Minimum effective capacity of reduced capacity tanks [A1]

Hazard Class	[A1] Minimum effective capacity [A1] m^3
LH - (Wet or pre-action)	5
OH1 - Wet or pre-action	10
OH1 - Dry or alternate OH2 - Wet or pre-action	20
OH2 - Dry or alternate OH3 - Wet or pre-action	30
OH3 - Dry or alternate OH4 - Wet or pre-action	50
HHP and HHS	70, but in no case less than 10% of the full capacity

Choice of Water Supply

- Single water supplies
- Superior single water supplies
- Superior twin water supplies
- Duplicate water supplies
- Combined water supplies

The most common tends to be a Superior single water supply

Superior single water supplies

Superior single water supplies are single water supplies which provide a higher degree of reliability. Typically these are a storage tank with two pumps (one primary & one stand-by), where the tank fulfils the following conditions:

- the tank shall be full capacity;
- there shall be no entry for light or foreign matter;
- suitable clean (see 8.1.2) water shall be used;
- the tank shall be painted or given other corrosion protection which reduces the need for emptying the tank for maintenance to periods of no less than 10 years.

Fire Pumps

Fire Pumps

- Fire pumps tend to be Diesel or Electrically driven.
- Most current LPC systems have either 1 Electric Pump, an Electric & a Diesel Pump or 2 Diesel Pumps.
- FM & NFPA systems tend to be supplied by 1 Diesel pump only
- Fire pumps are sized based on the design criteria applicable to the system
- On Superior Single Water Supplies 1 No. Electric Pump & 1 No. Diesel Pump tend to be provided

Fire Pump duties

Table TB210.T5 Minimum pump characteristics for LH and OH (pre-calculated systems) (replaces BS EN Table 16)							
Hazard class	(Non-high rise system) Height difference from pump – *h* or (High rise system) Lowest sprinkler in installation – *h* to highest sprinkler in installation m	Nominal data		Characteristic not less than			
		Pressure bar	Flow ℓ/min	Pressure bar	Flow ℓ/min	Pressure bar	Flow ℓ/min
LH (Wet or pre-action)	$h \leq 15$	1,5	300	3,7	225	–	–
	$15 < h \leq 30$	1,8	340	5,2	225	–	–
	$30 < h \leq 45$	2,3	375	6,7	225	–	–
OH1 Wet or pre-action	$h \leq 15$	1,2	900	2,2	540	2,5	375
	$15 < h \leq 30$	1,9	1 150	3,7	540	4,0	375
	$30 < h \leq 45$	2,7	1 360	5,2	540	5,5	375
OH1 Dry or alternate	$h \leq 15$	1,4	1 750	2,5	1 000	2,9	725
	$15 < h \leq 30$	2,0	2 050	4,0	1 000	4,4	725
OH2 Wet or pre-action	$30 < h \leq 45$	2,6	2 350	5,5	1 000	5,9	725
OH2 Dry or alternate	$h \leq 15$	1,4	2 250	2,9	1 350	3,2	1 100
	$15 < h \leq 30$	2,0	2 700	4,4	1 350	4,7	1 100
OH3 Wet or pre-action	$30 < h \leq 45$	2,5	3 100	5,9	1 350	6,2	1 100
OH3 Wet, high rise	$h \leq 15$	1,4+S[2]	2 250	2,9+S[2]	1 350	3,2+S[2]	1 100
	$15 < h \leq 30$	2,0+S[2]	2 700	4,4+S[2]	1 350	4,7+S[2]	1 100
	$30 < h \leq 45$	2,5+S[2]	3 100	5,9+S[2]	1 350	6,2+S[2]	1 100
OH3 Dry or alternate	$h \leq 15$	1,9	2 650	3,0	2 100	3,5	1 800
	$15 < h \leq 30$	2,4	3 050	4,5	2 100	5,0	1 800
OH4 Wet or pre-action	$30 < h \leq 45$	3,0	3 350	6,0	2 100	6,5	1 800

Note 1: For high rise system definition see BS EN 3.32
Note 2: S is the pressure equivalent to the height difference between the pump and the lowest sprinkler in the installation

Sprinkler system grading

For insurance purposes sprinkler systems shall be designated:

- Grade I
- Grade II
- Grade III

according to the number and type of water supplies.

Grade I Water Supplies

A Grade I system shall have either:

- duplicate water supplies (see BS EN Clause 9.6.3);

or

- one superior water supply (see BS EN Clause 9.6.2) provided that the total number of sprinklers fed by the supply does not exceed 2000 (excluding those in concealed spaces), and that there are not more than 200 sprinklers (excluding those in concealed spaces) in any single fire compartment. A fire compartment shall be separated by fire-resisting construction complying with TB206.

Grade II Water Supplies

- A Grade II system shall have one superior water supply (see BS EN Clause 9.6.2)
- The limitations on installation size specified for Grade I systems do not apply.

Grade III Water Supplies

A Grade III system shall have:

- a town main water supply (see BS EN Clause 9.2);

or

- an automatic pump complying with the requirements of BS EN Clause 10 *(superseded by TB210)* and with the water source requirements of BS EN Clause 9.6.

Control of design, installation & maintenance

- Independent certification of individual fire and security products is an important step for a manufacturer to take.
- Certification of the product alone cannot ensure that a protection system performs in the way it was designed unless its installation is carried out correctly.
- Product must be assembled into systems by skilled and experienced installers whose work complies with codes appropriate to the perceived hazard.
- The installed system must be maintained to ensure that the performance and reliability of the system is achieved throughout its installed life.

The Loss Prevention Certification Board

- The Loss Prevention Certification Board is concerned with these requirements: product listing, installation and maintenance.
- The LPCB 1048 scheme requires the installation of sprinkler systems to the highest reasonable standard, seeking to achieve this through a rigorous certification scheme.
- The scheme requires that LPCB certificated equipment be used and that installations be strictly in accordance with the "LPC Rules for Automatic Sprinkler Installations 2009", which incorporate BS EN 12845

LPS 1048 certification

The 1048 scheme allows for the recognition of installing companies operating at two levels.

- 'Certificated' installers are companies which have demonstrated their competence by the installation of a wide range of systems over a number of years, and have adequate design, installation and commissioning capability, by a suitably trained staff.
- ‘Registered' installers are companies who are working towards achieving requirements for certificated status and in the meantime are required to be supervised by a third party.

Requirements for Certificated Installers

- Capability to design, fabricate, erect and commission systems, and demonstrate this through evidence of previous systems, satisfactorily installed
- Operation of a quality management system to ISO 9001
- Agreements for the direct supply of sprinkler equipment from an LPCB listed sprinkler equipment supplier(s)
- Employment of required number of staff experienced in the design of sprinkler installations
- Provision of a maintenance service with an emergency callout facility, able to take remedial action on site within a period of 24 hours

Requirements for Certificated Installers (cont'd)

- Registered installers are limited in their operating scope, only installing hydraulically calculated installations when an adequate 'track-record' of experience is gained.
- Certificated and registered installers are audited by the LPCB at least twice a year depending on approval level. The audit involves a review of internal quality assurance procedures and also includes an inspection of a sample of completed sprinkler installations.
- Installing companies will issue LPCB Certificates of Conformity for each correctly completed installation, records of which will be kept by the LPCB.
- Certificates of Conformity will only remain valid if the sprinkler installation is maintained according to stipulated requirements.

LPS 1048 approval levels

TABLE 1

Category of Work		Approval level			
		1	2	3	4
A	Pre-calculated ordinary hazard systems, installations, extensions and alterations (excluding water supplies)	✓①	✓ ②	✓ ②	✓ ③
B	Pre-calculated high hazard systems, installations, extensions and alterations (excluding water supplies)	✓ ①	✓ ②	✓ ②	✓ ③
C	Town's main water supplies	✓ ①	✓ ②	✓ ②	✓ ③
D	Pumped water supplies	✓ ①	✓ ②	✓ ②	✓ ③
E	Base build contracts (pre-calculated design principles)	X	✓ ②	✓ ②	✓ ③
F	Systems, installations, extension and alterations involving FHC design principles	X	X	✓ ①	✓ ③

✓ ① - Allowed to undertake this Category of Work under supervision.

✓ ② - Allowed to undertake this Category of Work, supervision may be required depending on whether the Contractor has been granted self-certification for this Category of Work.

✓ ③ - Allowed to undertake this Category of Work, Contractor can self-certificate this Category of Work.

X - Not allowed to tender for or undertake this Category of Work.

Specifiers & end users

Specifiers & end users should ensure:-

- The installing contractor is ‘approved’ to carry out the work involved
- All applicable products installed should be LPCB approved and listed in the ‘Red book’ www.redbooklive.com
- The system should be maintained by an appropriately certified sprinkler contractor and the inspector should have passed the relevant competency review exams for the inspected system

What to avoid!

Idle Pallet Storage not picked up by a level 4 company's 'Inspector'. System was OHIII!

Types of system and alarm valves

According to the LPC rules the following types of alarm valve are considered suitable for sprinkler service:

- Wet alarm valve
- Dry alarm valve
- Pre-action alarm valve

Wet alarm valves

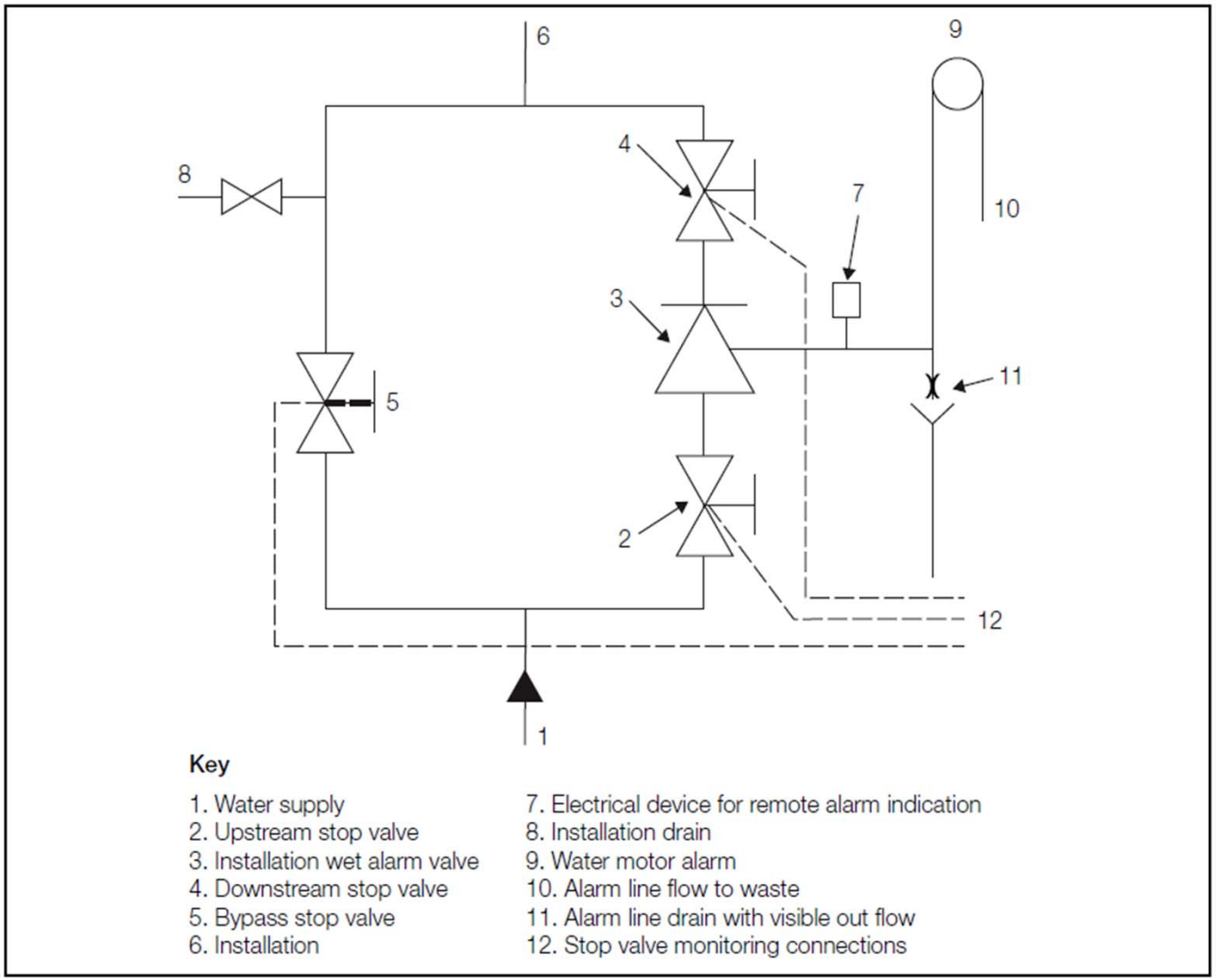
The wet alarm valve is the most common arrangement of alarm valve and has two principle functions.

a) acts as a non-return or check valve

b) sounds an alarm when water flows

- Wet pipe alarm valves as the name suggests can only be employed where the installation may be permanently charged with water even during winter months.
- Wet alarm valves should be fitted with a by-pass arrangement or a duplicate set of alarm valves as standard.

Wet alarm valve schematic



Key

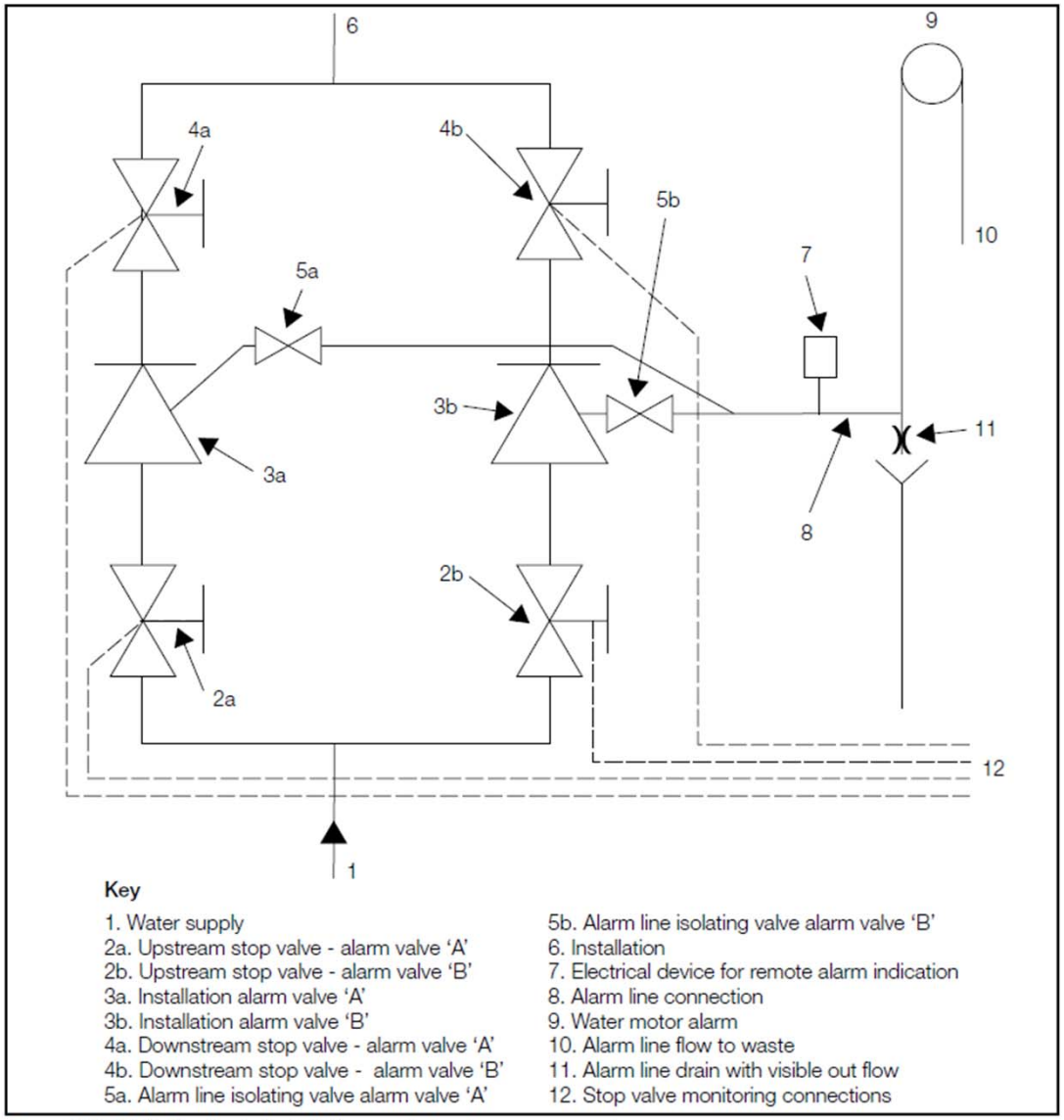
1. Water supply
2. Upstream stop valve
3. Installation wet alarm valve
4. Downstream stop valve
5. Bypass stop valve
6. Installation
7. Electrical device for remote alarm indication
8. Installation drain
9. Water motor alarm
10. Alarm line flow to waste
11. Alarm line drain with visible out flow
12. Stop valve monitoring connections

Figure TB232.F1 Wet pipe installation control valve arrangement with bypass

Dry alarm valves

- Dry alarm valves are most commonly used in installations subject to freezing or hot process risks where range temperatures exceed 70°C.
- Dry pipe alarm valves should only be used where it is impractical to employ a wet pipe alarm valve and should be avoided in high hazard applications.
- Duplicate installation control valves should be used on dry-pipe installations.

Dry alarm valve schematic



Key

1. Water supply
2a. Upstream stop valve - alarm valve 'A'
2b. Upstream stop valve - alarm valve 'B'
3a. Installation alarm valve 'A'
3b. Installation alarm valve 'B'
4a. Downstream stop valve - alarm valve 'A'
4b. Downstream stop valve - alarm valve 'B'
5a. Alarm line isolating valve alarm valve 'A'
5b. Alarm line isolating valve alarm valve 'B'
6. Installation
7. Electrical device for remote alarm indication
8. Alarm line connection
9. Water motor alarm
10. Alarm line flow to waste
11. Alarm line drain with visible out flow
12. Stop valve monitoring connections

Figure TB232.F2 Duplicate installation control valve arrangement

Pre-action alarm valves

- Pre-action alarm valves are variations on the dry pipe alarm valve. They are commonly used in sensitive areas i.e. computer rooms etc. They additionally employ an independent fire detection system and control panel. The fire detection system is either used to accelerate operation of the pre-action valve (Type B) by opening it in advance of a sprinkler head operation or to prevent unintentional water discharge from a damaged sprinkler head (Type A).
- These installations are expensive compared to standard wet or dry pipe installations due to the need for the fire alarm control equipment and power supplies.
- Duplicate installation control valves should be used on pre-action installations.

Alternate & Deluge Valves

- The alternate pipe alarm valve is designed to operate as a wet pipe when there is no risk of freezing and a dry valve in the winter months when there is the possibility of freezing. They are no longer considered appropriate for sprinkler service due to the potential for accelerating the rate of pipework corrosion and have therefore been excluded from the LPC list.

- Deluge valves are employed on sprinkler or spray systems with open heads where it is necessary to discharge water over an entire area. This is usually in areas were rapid fire spread is expected and often where cooling storage tanks or plant may be necessary. Deluge Valve are not included in the LPC Standard.

Water Motor Alarm (Alarm Gong)

- These alarm devices are used in conjunction with each of the alarm valves described in this section. The device consists of a water impeller which drives a mechanical gong via a drive shaft.
- Each control valve set should be provided with a water motor alarm in accordance with EN 12259-4 and an electrical device for remote alarm indication, both located as close as possible to the alarm valve.
- The electrical device for remote alarm indication generally takes the form of a pressure switch mounted on the installation control valve trim which activates when the pressure in the system drops to a predetermined level or a flow switch installed downstream of the control valve which activates when a flow of water passes through it.

Water Motor Alarm (Alarm Gong)

Protection of storage

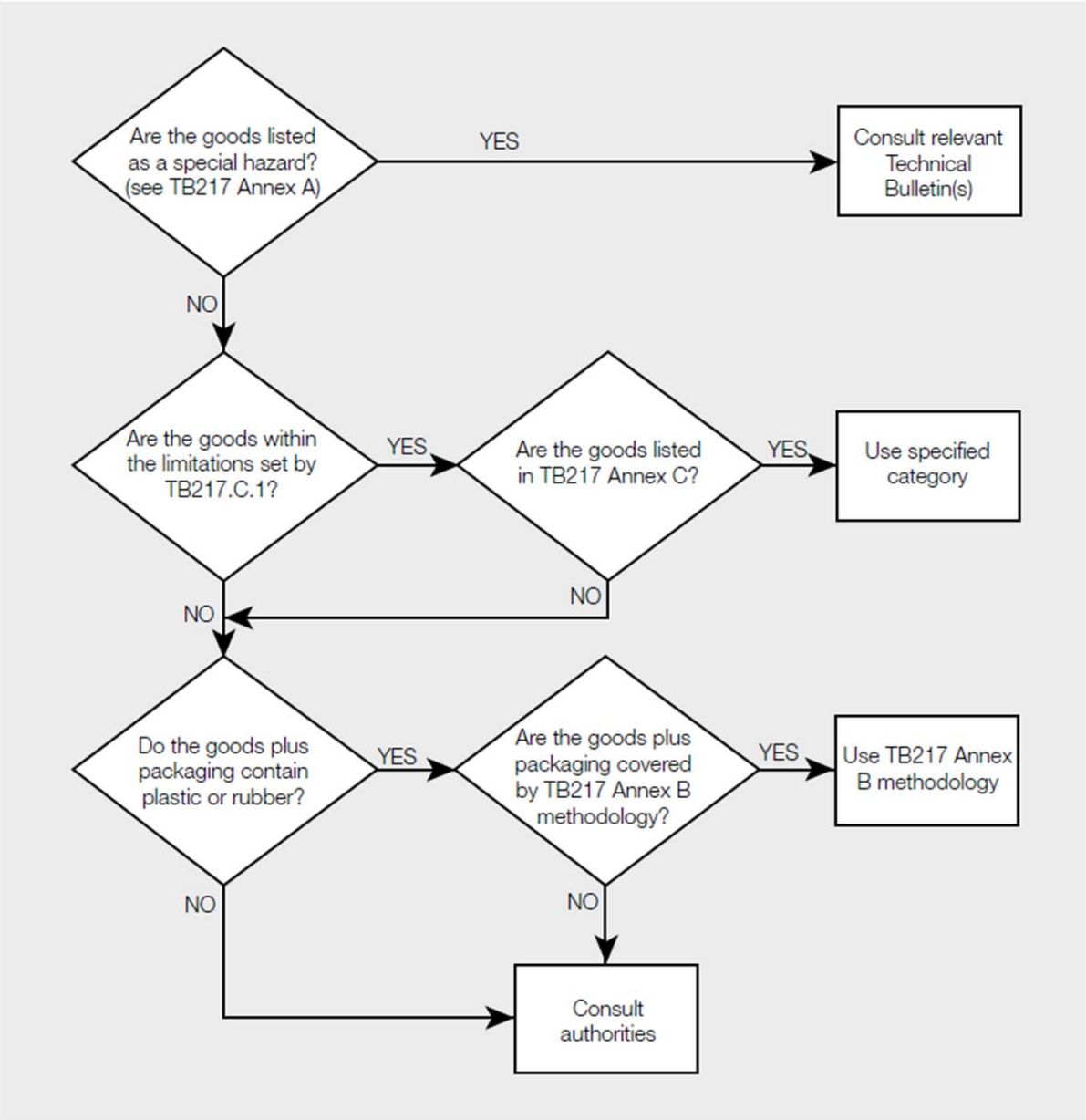
The overall fire hazard of stored goods is a function of the combustibility of the materials being stored including their packaging, and of the storage configuration.

The principle factors which affect the nature of the sprinkler protection required for storage risks are:

- The Category of Goods Stored
- The Method of Storage
- The Height of Storage

To determine the required design criteria when stored goods are involved each of the items 1 to 3 above must be established.

Categorisation of Goods



TB217.F1 Flow chart for determining the category of goods stored

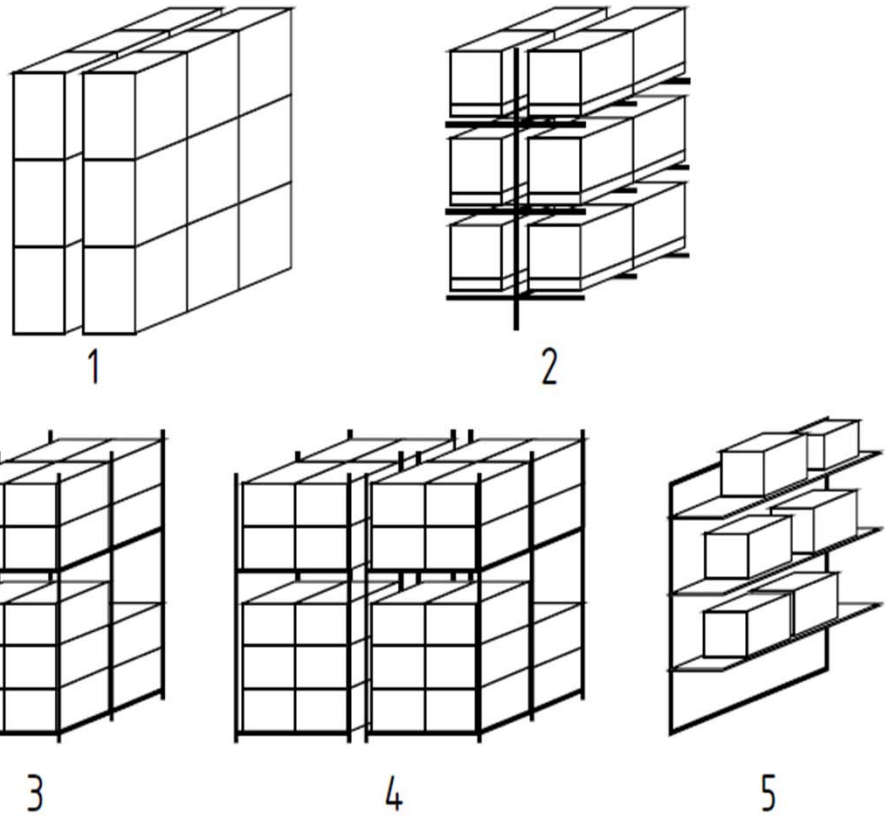
To establish the category of goods the procedure shown in TB217.F1 should be followed:-

Storage Configuration

The storage configuration shall be classified as follows:

- ST1: free standing or block stacking;
- ST2: post pallets in single rows, with aisles not less than 2,4 m wide;
- ST3: post pallets in multiple (including double) rows;
- ST4: palletized rack (beam pallet racking);
- ST5: solid or slatted shelves 1 m or less wide;
- ST6: solid or slatted shelves over 1 m and no more than 6 m wide;

Examples of Storage Configuration



Key

1 Free-standing storage (ST1)
2 Palletized rack (ST4)
3 Post-pallet storage (ST2)
4 Post-pallet storage (ST3)
5 Solid or slatted shelves (ST 5/6)

Height of Storage

- Height of storage shall be measured from the floor to the top of the highest goods stored for each category of goods.
- Once factors 1 -3 have been established the design criteria can be determined.
- Where multiple storage configurations are present the worst case configuration should be considered when establishing the required design criteria.
- By using the following table we can establish what the required design density for roof only sprinklers would be:-

Roof Sprinklers Only

Table TB229.T2 — Design criteria for HHS with roof or ceiling protection only (Replacing BS EN Table 4)						
Storage configuration	Maximum permitted storage height[1] m				Design density mm/min	Area of operation (wet or pre-action system[2, a, b]) m²
	Category I	Category II	Category III	Category IV		
ST1 Free standing or block stacking	5,3 6,5 7,6	4,1 5,0 5,9 6,7 7,5	2,9 3,5 4,1 4,7 5,2	1,6 2,0 2,3 2,7 3,0	7,5 10,0 12,5 15,0 17,5	260
			5,7 6,3 6,7 7,2	3,3 3,6 3,8 4,1 4,4	20,0 22,5 25,0 27,5 30,0	300
ST2 Post pallets in single rows	4,7 5,7 6,8	3,4 4,2 5,0 5,6 6,0	2,2 2,6 3,2 3,7 4,1	1,6 2,0 2,3 2,7 3,0	7,5 10,0 12,5 15,0 17,5	260
ST4 Palletized racks			4,4 ***4,8*** 5,3 ***5,6*** 6,0	3,3 ***3,6*** 3,8 ***4,1*** 4,4	20,0 ***22,5*** 25,0 ***27,5*** 30,0	300
ST3 Post pallets in multiple rows ST5 and ST6 Solid or slatted shelves	4,7 5,7	3,4 4,2 5,0	2,2 2,6 3,2	1,6 2,0 2,3 2,7 3,0	7,5 10,0 12,5 15,0 17,5	260

Note 1: The vertical distance from the floor to the sprinkler deflectors, minus 1m, or the highest value shown in the table, whichever is the lower.

Note 2: Dry ~~and alternate~~ systems should be avoided on High Hazard storage especially with the more combustible products (the higher categories) and the higher storage.

[a] ***LPC Rules requirements – Alternate systems are no longer permitted.***

[b] ***LPC Rules requirements – Should it nonetheless be necessary to install a dry system, the area of operation should be increased by 25%.***

For example; for a Palletized Rack storage configuration (ST4) with Category III goods stacked 4.1m high, the required design density for a Wet Sprinkler Installation would be 17.5mm/min over a 260m² area of operation.

Please note vertical alignment of figures in cells is incorrect. Figures are aligned centrally. Figures should be aligned to the top of each corresponding cell i.e. Cat 1, ST1 should be 7.5mm/min density for 5.3m storage height not 10mm/min

In-Rack Sprinklers

- In instances where storage configurations are outside the scope of Table TB229.T2 or there are other factors which render the installation of a high density roof only sprinkler system impossible, in-rack sprinklers can be employed.
- By installing in-rack sprinklers the design density at roof level can be substantially reduced. This can mean a smaller and consequently cheaper water supply.

Table TB229.T3 Design criteria for roof or ceiling sprinklers with in-rack sprinklers (Replacing BS EN Table 5)

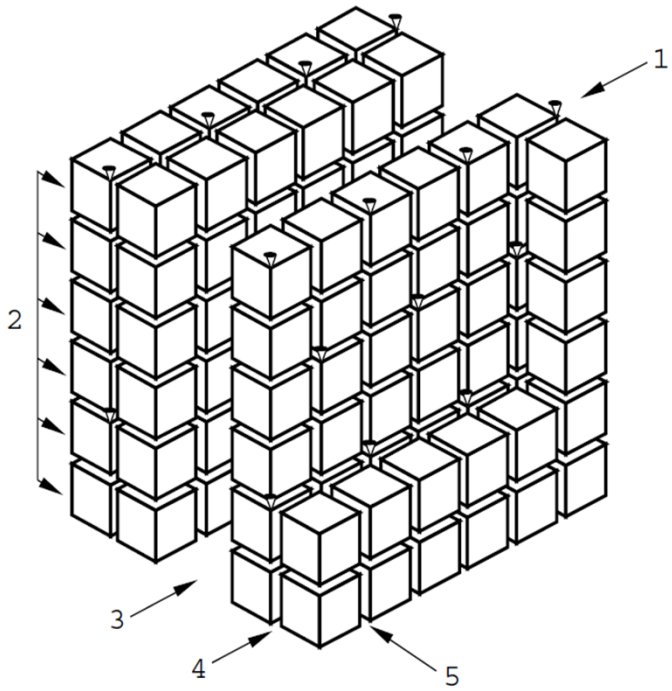
Storage configuration	Maximum permitted storage height above the top level of in-rack protection[1] m				Design density mm/min	Area of operation (wet or pre-action system[2]) m^2
	Category I	Category II	Category III	Category IV		
ST4 Palletized racks	3,5	3,4	2,2 2,6 3,2 3,5	1,6 2,0 2,3 2,7	7,5 10,0 12,5 15,0	260
ST5 and ST6 Solid or slatted shelves	3,5	3,4	2,2 2,6 3,2	1,6 2,0 2,3 2,7	7,5 10,0 12,5 15,0	260

Note 1: The vertical distance from the highest level of in-rack sprinklers to the top of the storage.
Note 2: Dry ~~and alternate~~ systems should be avoided on High Hazard storage especially with the more combustible products (the higher categories) and the higher storage.
[a] ***LPC Rules requirement – Should it nonetheless be necessary to install a dry system, the area of operation shall be increased by 25%.***

In-Rack Sprinklers in ST4 racks

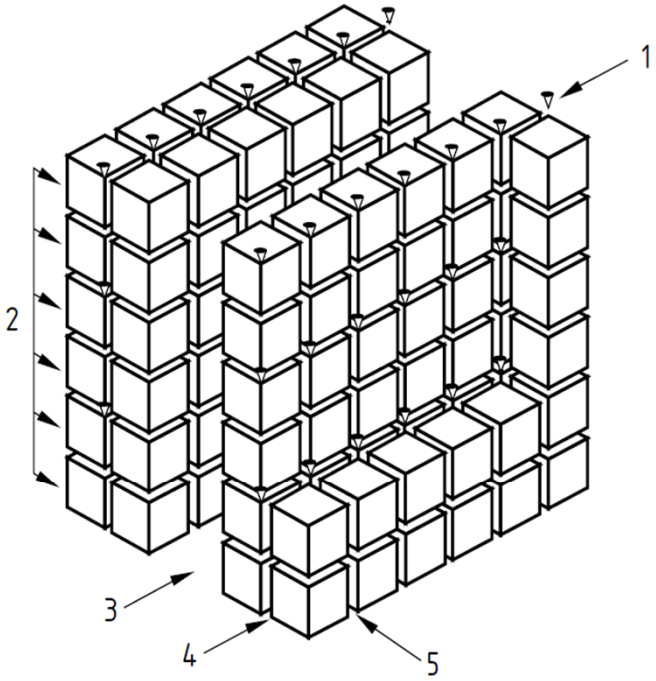
- In-rack sprinklers when used are typically installed in Palletized rack (ST4) storage configurations.
- Depending on the Category of Goods stored in the racks, the sprinkler head locations vary.
- For Category I or II goods the sprinklers are spaced at each alternate transverse flue
- For Category III or IV goods the sprinklers are located at each transverse flue
- See figures 13 & 14 respectively from the LPC rules

Figures 13 & 14



Key
1 Sprinkler row
2 Tiers
3 Aisle
4 Longitudinal flue
5 Transverse flue

Figure 13 — Location of rack intermediate level sprinklers – Category I or II



Key
1 Sprinkler row
2 Tiers
3 Aisle
4 Longitudinal flue
5 Transverse flue

Figure 14 — Location of rack intermediate level sprinklers – Category III or IV

Sprinklers, life safety and the building regulations

A Life Safety System is a ‘term applied to sprinkler systems forming an integral part of measures required for the protection of life, especially where evacuating the building depends on the performance of the sprinkler system and sprinklers are required expressly for life safety purposes’.

Annex F

Annex F of the LPC Rules details the special requirements for Life Safety Systems. These include:-

- Installations shall be subdivided into zones.
- Sprinkler installations shall be of the wet pipe type
- Quick response sprinklers shall be used*
- During servicing the sprinkler installation shall be fully operational in all aspects.
- The partial or complete shut-down of a life safety sprinkler installation shall be avoided wherever possible.
- Flow switches on life safety systems shall be checked for correct function on a quarterly basis.

Building Regulations

- Different building regulations apply throughout the UK & Ireland
- England & Wales – Approved document B. Approved Document B refers to BS 5306 Part 2 & BS EN 12845 and this is what is referenced in the LPC rules.
- Northern Ireland – Technical Booklet E - Refers to BS 5306 Part 2 only
- Republic of Ireland – Technical Guidance Document B - Refers to BS 5306 Part 2 only
- All require the installed sprinkler system to be a Life Safety System

Building Regulations benefits

In general:-

- Sprinklers can increase the permitted escape distances
- Sprinklers can increase the minimum periods of fire resistance for elements of the building structure & components
- Sprinklers can increase the maximum floor areas and volumes of building or compartments

Bottom line there are significant commercial and Health & Safety advantages to be gained from installing sprinklers

Q & A