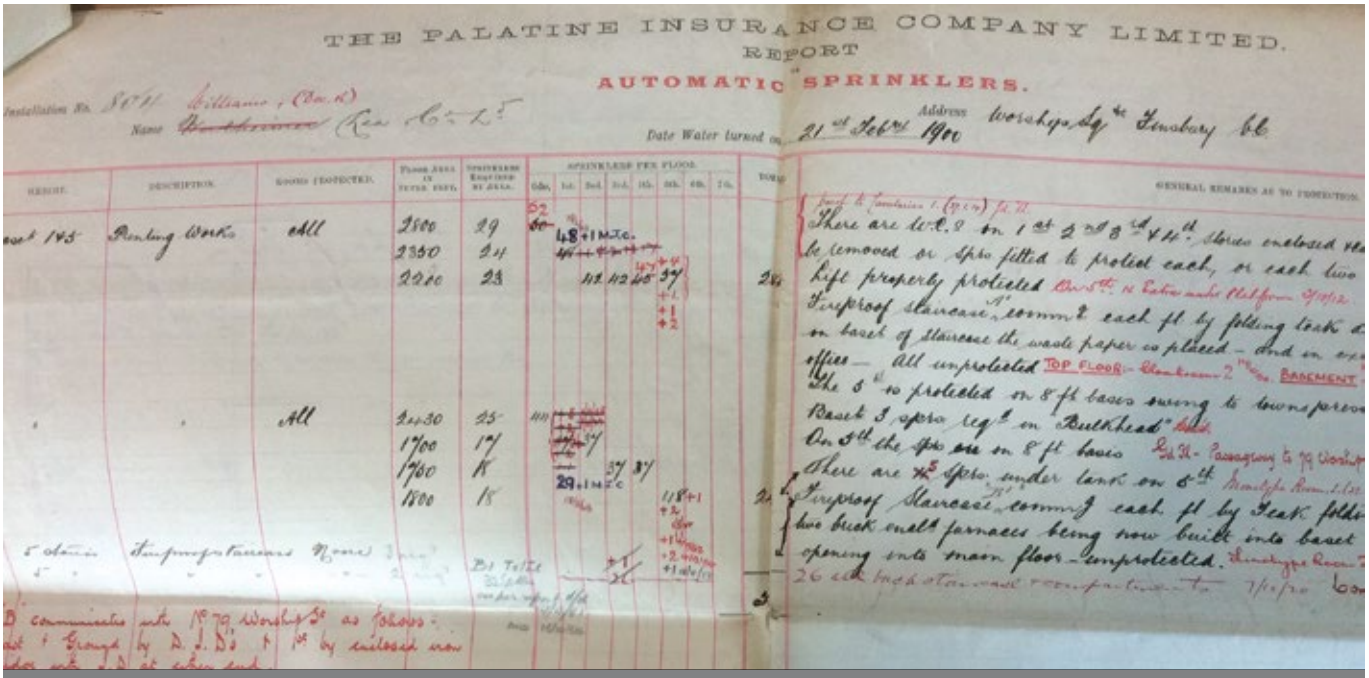
bafsa

Information File

Sprinklers and the Insurance Industry

1st Issue
February 2015
BIF 26


THE PALATINE INSURANCE COMPANY LIMITED.
REPORT
AUTOMATIC SPRINKLERS.

Insurers' Sprinkler Report for a printing works dated 1900-9

Introduction

It's no exaggeration to say that the insurance industry was the impetus for the development of the automatic fire sprinkler system. Both in the US and later in the UK, in the second half of the 19th century insurers were increasingly unwilling to take on the risks of large cotton and woolen mills which generated significant fire losses.

Sprinklers as we might begin to recognise them today trace their origins back to a system initially devised by Lt Col Sir William Congreve (the pioneer of rockets as artillery) to protect the stage area of the Theatre Royal, Drury Lane in 1812. Like cotton mills, theatres were a frequent victim of devastating fires. However, the first modern, comprehensive sprinkler system was invented by Henry Parmelee in 1874 which was used to protect his piano factory in New Haven, Conn. Reportedly, he did so as a result of several fires. He had little success in selling his ideas until a Major Hesketh, a mill owner and a director of the Bolton Cotton Trades Mutual Insurance Company, invited him to come to England where he installed his first system in a cotton mill at Astley Bridge followed by Bolton's Alexandra Mills. This led to an introduction to another North West insurer, the Mutual Fire Insurance Company of Manchester which had been founded in 1870 and pioneered what we might recognise as 'risk management'. Some 10 mills and factories in the area were sprinklered by 1883.

So, the high costs and limited availability of insurance in some industrial sectors gave birth to sprinklers, and even today the insurance industry is a strong determinant in the decision to fit sprinklers in industrial and commercial buildings.

Standards for Automatic Sprinkler Systems

Insurers have always also played a key role in the development and formulation of standards for fire protection sprinkler systems. In the US, the formation of the NFPA in 1896 was greatly aided by the funding and influence of insurers and it would not be an exaggeration to say that one of the primary motivators for its formation was a desire to standardise the design and installation of sprinkler systems. In fact one of the NFPA's first standards to be produced in its year of foundation was: *Rules and Regulations of the National Board of Fire Underwriters for Sprinkler Equipment*. This document was then placed in the hands of the first NFPA technical

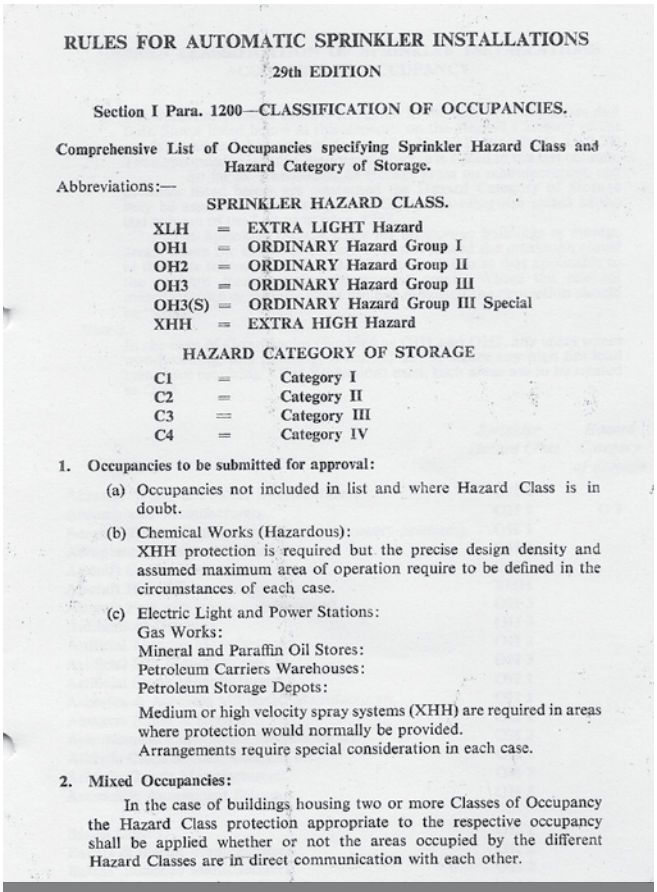
Early soldered sprinkler head - still recognisable for what it does

committee in 1897 and a revised version was then published as NFPA 13.

In fact, the nascent NFPA 13 was preceded in 1891 by the Associated Factory Mutual Company's guidelines *Location and Spacing for Automatic Sprinklers*. This company is now FM Global who continue to undertake research on sprinkler effectiveness and publish their own data sheets which are widely used around the world as an alternative to national standards and NFPA 13.

In the UK, John Wormald of the Mutual Fire Insurance Corporation, Manchester, prepared the first-ever sprinkler rules in 1885. In 1888, these rules were adopted by the Fire Offices' Committee for their own members (virtually all of the companies underwriting fire business in the UK at that time). In June 1892, the FOC published the first edition of the FOC *Rules for Automatic Sprinkler Installations*. These standards, although regularly updated, remained little changed until the publication of the 28th edition in 1960. The final version of the 28th edition tried to take account of the changes in fire hazard resulting from the production and wider use of plastics which had proved to be a problem for earlier sprinkler systems. The 29th (and last) edition of the FOC rules in December 1968 required further major changes 'to meet the wide occupancy hazard conditions now prevailing'. The 1970 revision introduced three hazard classifications: Extra Light Hazard, Ordinary Hazard and Extra High Hazard. The Rules were revised again in 1983 (mainly to take account of metrication) and again in 1985.

The British Standards Institute (BSi) had twice attempted to publish sprinkler design and installation standards itself. The first attempt in 1952 was published as CP402.201 (1952) this was succeeded by an embryonic BS 5306 Part 2 in 1979. However as most of the sprinkler systems being installed at the time had insurance involvement, the primacy of the FOC Rules was maintained and there was little interest in either document.
In 1986 the FOC was disbanded and responsibility for the UK's sprinkler rules was passed to a new insurance-funded body, the Loss Prevention Council. The FOC had already been in discussions with the British Standards Institute over the possible re-configuring of the FOC Rules to meet BSi's practices and it was agreed that BSi would take over publication with what would have been the 30th edition FOC Sprinkler Rules becoming BS 5306 Part 2 in 1990. However this change did not mean that the insurers' interest was lost. The need for additional requirements to be imposed beyond what was specified in the BS where systems were either being mandated by insurers or where premium discounts were being offered was covered by production of a set of new documents, the Technical Bulletins (TB's) of the *LPC Rules for Automatic Sprinkler Systems*. Unusually, BSi had licensed the LPC to print and sell the text of BS 5306 Part 2.



RULES FOR AUTOMATIC SPRINKLER INSTALLATIONS

29th EDITION

Section I Para. 1200—CLASSIFICATION OF OCCUPANCIES.

Comprehensive List of Occupancies specifying Sprinkler Hazard Class and Hazard Category of Storage.

Abbreviations:—

SPRINKLER HAZARD CLASS.

XLH	=	EXTRA LIGHT Hazard
OH1	=	ORDINARY Hazard Group I
OH2	=	ORDINARY Hazard Group II
OH3	=	ORDINARY Hazard Group III
OH3(S)	=	ORDINARY Hazard Group III Special
XHH	=	EXTRA HIGH Hazard

HAZARD CATEGORY OF STORAGE

C1	=	Category I
C2	=	Category II
C3	=	Category III
C4	=	Category IV

1. Occupancies to be submitted for approval:
   (a) Occupancies not included in list and where Hazard Class is in doubt.
   (b) Chemical Works (Hazardous):
   XHH protection is required but the precise design density and assumed maximum area of operation require to be defined in the circumstances of each case.
   (c) Electric Light and Power Stations:
   Gas Works:
   Mineral and Paraffin Oil Stores:
   Petroleum Carriers Warehouses:
   Petroleum Storage Depots:
   Medium or high velocity spray systems (XHH) are required in areas where protection would normally be provided.
   Arrangements require special consideration in each case.
2. Mixed Occupancies:
   In the case of buildings housing two or more Classes of Occupancy the Hazard Class protection appropriate to the respective occupancy shall be applied whether or not the areas occupied by the different Hazard Classes are in direct communication with each other.

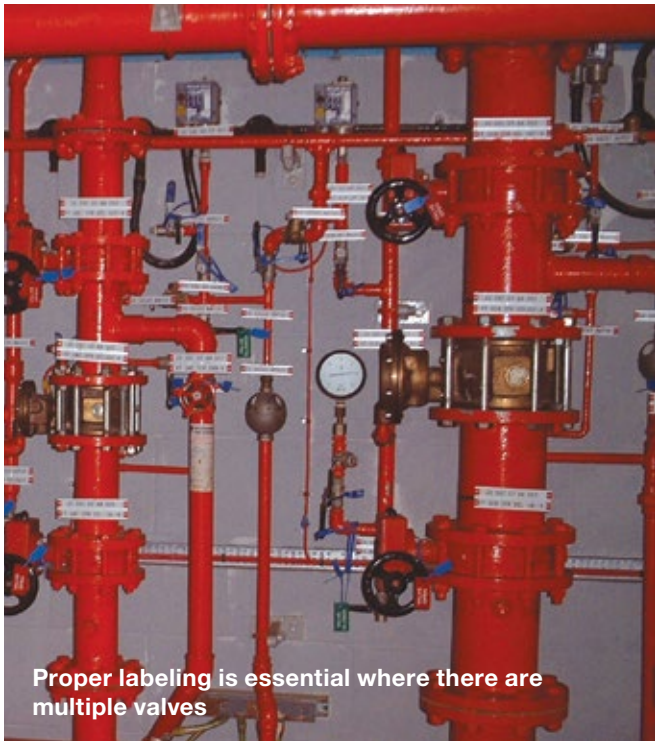
FOC Rules 29th Edition - 1970: Introduction of Hazard Classifications

This was produced in a binder together with copies of the LPC Technical Bulletins (TB's). The TB's, as now, covered a wide variety of requirements relating to such things as approved components, pipework, water supplies and special measures for hazards which were not fully covered in the BS such as hanging garment storage. One feature of the LPC version of BS 5306 Part 2 were marginal corrections in colour to correct the many errors in the text.

At this time, there were other standards available to guide sprinkler installers and users. The European

insurance association, CEA, had produced a design standard which owed quite a lot to the FOC Rules and there were in addition, national standards in several European countries. The FOC Rules were also used extensively outside Europe and there was even the FOC Rules (Foreign) which formed part of local regulations in a number of countries such as Hong Kong and Singapore and continued to be called up several years after the publication of the British Standard.

In 2003 the European Committee for Standardization (CEN) approved EN 12845 and this was published in English by BSi as BS EN 12845:2003. This necessitated a new set of Technical Bulletins and these plus the text of BS EN 12845 were published by the Fire Protection Association as the updated *LPC Rules for Automatic Sprinkler Installations 2003*. Revisions of EN 12845 took place in 2004 and 2009 and a new set of LPC Rules was also published in 2009 and again in 2011. A set of minor revisions of EN 12845 is expected to be issued in the summer of 2015. This will be followed by a major review in 2017/8. 2015 will also see the publication of a new set of the LPC Rules.



Proper labeling is essential where there are multiple valves

Hazard Classifications

Sprinkler systems in production areas should be designed for classes of occupancy based on their inherent fire hazard. Operations involving the manufacture or use of plastics typically need heavier duty protection than, for example, processes involving paper. Systems in storage areas are generally heavier duty than those in production areas and will vary in design depending on the nature of the stored materials, whether these are in racks or palletised and the height of storage and the building's roof or ceiling. "Special hazards" such as flammable and combustible liquids and aerosols or hanging garments may need specialised systems.

LPCB Listed diesel-driven pumpset being installed to replace older unit

Third Party Certification

The sprinkler industry has been served by a form of third party certification schemes since the days of the FOC's *List of Approved Sprinkler Installers*. Following the formation of the LPC and the Loss Prevention Certification Board, there has been a formal, structured scheme in place to certificate and list sprinkler installers who comply with certain specific requirements. Sprinkler system components are also subject to an approval and listing scheme.

The original LPCB scheme, now known as the LPCB/BRE Certification scheme for sprinkler installers, usually known as the LPS 1048[1] scheme is the oldest of the schemes covering the installers of sprinkler systems in the UK. Other schemes now cover residential and domestic systems. There are now three certification bodies approved by the Westminster Government's *United Kingdom Accreditation Service* (UKAS). These are: Warrington FIRAS (covering industrial and commercial systems and residential systems) and IFC Certification Ltd (covering residential systems). For more details and contact information see BAFSA Information File 20 *Third Party Certification*.

While third party certification is not required by law its use should always be encouraged to ensure that sprinklers are designed and installed precisely as intended and expected. While it is likely that individual insurance technical specialists will have experience of the capabilities and competence of a number of installers, the certification scheme provides an ongoing, independent assessment of the quality of the work undertaken.

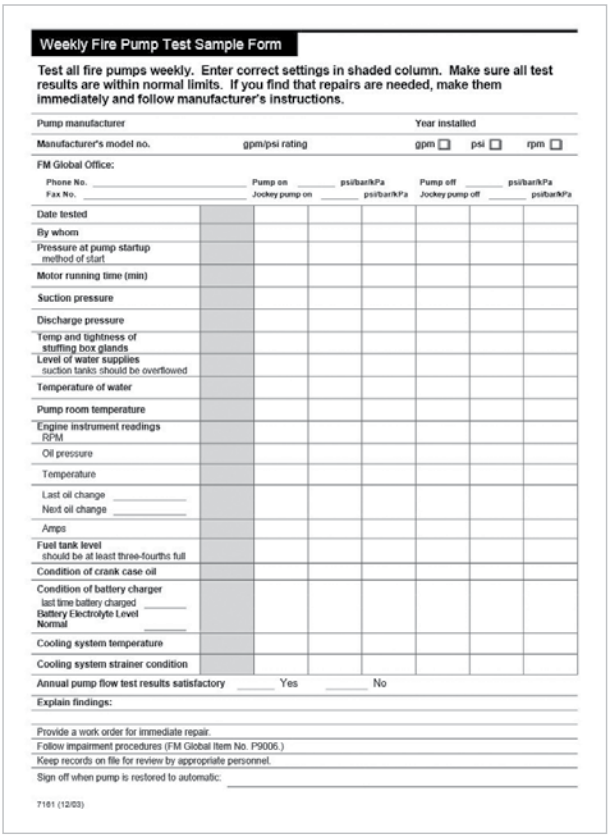
1 http://www.redbooklive.com/pdf/LPS_1048-1_Issue_4_1.pdf

There is support from the fire and rescue service and other regulators for the concept that utilising third party certificated products and installers provides some defence in law in respect of duties under UK fire regulations.

Both Approved Document B of the Building Regulations and the Scottish Technical Handbooks encourage the use of third party certification and the guidance documents to the Regulatory Reform (Fire Safety) Order 2005 and the Scottish Fire Regulations also commend this practice.

Maintenance

Proper maintenance of sprinkler systems is critical to their effective operation. As with any system which is rarely called on to operate, it's only by a structured programme of inspection, testing and maintenance that one can reasonably expect a system to operate as designed - perhaps for the first time in 40 years. That being said, the present standards used in the UK do have some degree of in-built conservatism and it is probable that even where unexpected fire conditions are present the sprinklers will still operate and contain a fire. Data collected over 10 years by London Fire Brigade suggests that the primary cause of sprinklers failing to operate is either the system being shut off or disconnected from the water supply. (See *BIF 19 Sprinkler Reliability*) and this is consistent with US NFPA statistics.



Weekly Fire Pump Test Sample Form

Test all fire pumps weekly. Enter correct settings in shaded column. Make sure all test results are within normal limits. If you find that repairs are needed, make them immediately and follow manufacturer's instructions.

Pump manufacturer — Year installed

Manufacturer's model no. — gpm/psi rating — gpm ☐ psi ☐ rpm ☐

FM Global Office:

Phone No. — Pump on ____ psi/bar/kPa — Pump off ____ psi/bar/kPa

Fax No. — Jockey pump on ____ psi/bar/kPa — Jockey pump off ____ psi/bar/kPa

Date tested							
By whom							
Pressure at pump startup method of start							
Motor running time (min)							
Suction pressure							
Discharge pressure							
Temp and tightness of stuffing box glands							
Level of water supplies suction tanks should be overflowed							
Temperature of water							
Pump room temperature							
Engine instrument readings RPM							
Oil pressure							
Temperature							
Last oil change Next oil change							
Amps							
Fuel tank level should be at least three-fourths full							
Condition of crank case oil							
Condition of battery charger last time battery charged Battery Electrolyte Level Normal							
Cooling system temperature							
Cooling system strainer condition							

Annual pump flow test results satisfactory ____ Yes ____ No

Explain findings:

Provide a work order for immediate repair.

Follow impairment procedures (FM Global Item No. P9006.)

Keep records on file for review by appropriate personnel.

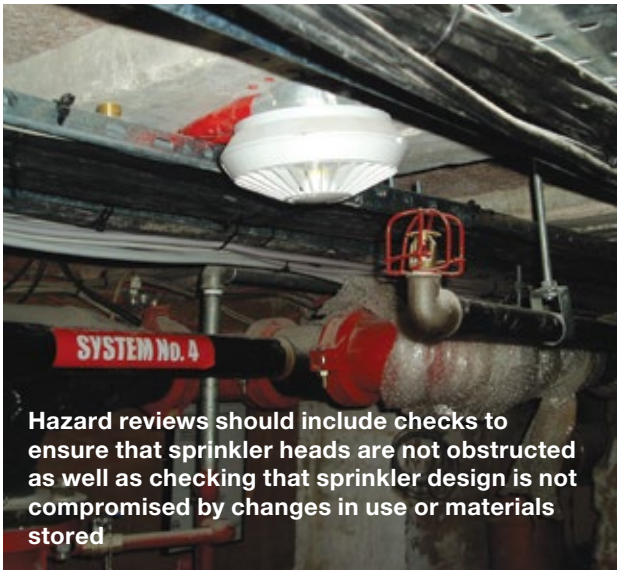
Sign off when pump is restored to automatic: ____

7101 (12/03)

Recording of testing and maintenance is essential. Logbooks may be supplied by insurers or installers.

Sprinkler system maintenance is covered in Section 20 in BS EN 12845 and in Technical Bulletin 203 of the LPC Rules. Note that there are minor differences in the two sets of requirements. There is a useful summary of the requirements in BIF *16b Sprinkler System maintenance to BS EN 12845*.

Note that the routine weekly checks and tests can usually be undertaken by suitably trained staff or contractors. A specialist sprinkler installer should however, undertake the six monthly and annual checks.



Hazard reviews should include checks to ensure that sprinkler heads are not obstructed as well as checking that sprinkler design is not compromised by changes in use or materials stored

Hazard Review

BS EN 12845 requires that a hazard review be undertaken 'at intervals of no more than 13 weeks'. This process should determine whether there have been changes in the nature of storage, height, format etc or the introduction of special hazards or changes in production areas which could affect the occupancy or change the hazard classification. Failure to recognise this could seriously impact on the successful operation of the sprinkler system. TB 203 originally suggested that this quarterly review could be undertaken 'by a competent person who is not an employee of the user'. However it is now permissible for the user to undertake three out of the four hazard reviews provided that copies of the reviews are sent to the sprinkler contractor. Obviously, insurers will want to be assured that such reviews are being undertaken properly.

Record Keeping

Good record keeping is fundamental to the maintenance process and the certainty that a sprinkler system will operate when called on to do so. A record book or similar should be maintained by the user and checked by the insurance surveyor or other inspector. All maintenance activity should be logged. Some insurance companies provide their own logs for this purpose. TB 203.5.1 carries a good summary of what is required.

Legal Requirements

In England and Wales, where fire protection systems are installed for the protection of life it is a statutory requirement (Article 17, Regulatory Reform (Fire Safety) Order 2005) that this be 'subject to a suitable system of maintenance and [are] maintained in an efficient state, in efficient working order and in good repair'. In Scotland, similar obligations are imposed under S16. of the Fire Safety (Scotland) Regulations 2006.

Inspecting Systems

Because of the considerable reliance placed upon sprinkler systems to minimise fire damage and the significant insurance premium discounts which are allowed, Insurers will often inspect them on a regular basis. Generally, this will be the insurer of the party deemed responsible for the sprinkler installation who will carry out the inspection, although this is not necessarily always the case. In some instances it will be the building insurer, in others the contents insurer, or even both in some circumstances. Some insurers employ specialist fire or sprinkler engineering consultants for this purpose. Typically, the inspector will wish to witness a fire pump test. If suitable records are not available, this may include flowing water through the test line to ensure the pump is still meeting its designed performance curve.

Large electrically-driven pump with coupling protection

Each surveyor or inspector will have his or her own approach to inspecting a sprinkler system and most companies will have their own proforma inspection reports for recording information. However the following are suggested as essential parts of any audit:

Water Supplies

Tank structure

- When was last internal examination carried out?
- Signs of corrosion
- Trace heating system where present
- Lining
- Suction supply valve strapped/locked open

Checks should include fuel level in diesel tank

Pump House

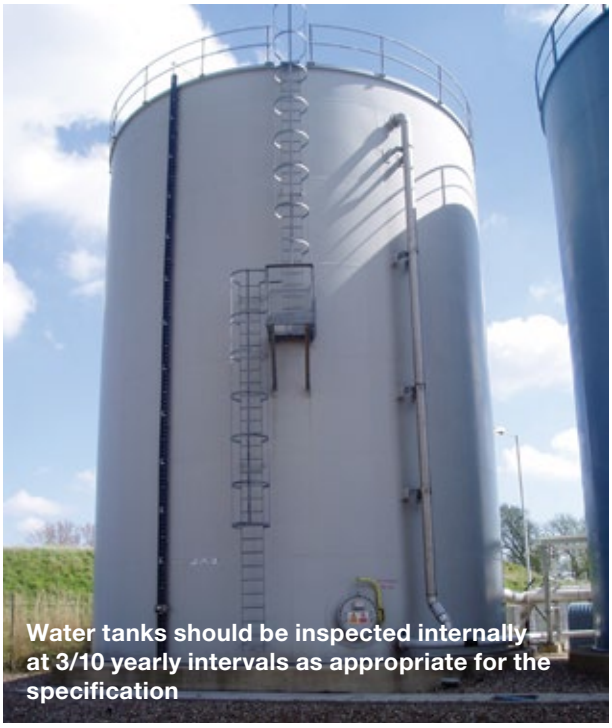
- Secure
- Clean and dry
- Frost protection/precautions to maintain pumphouse at either 4º or 10ºC as appropriate
- Suction valves strapped/locked open
- Power supply to control panels on
- Batteries charging
- Electric pump set to 'Automatic'
- Diesel pump set to 'Automatic'
- Pressure switches set with differential between electric and diesel pumps
- Diesel pump fuel tank level
- Pressure gauge readings
- If pumps are to be tested, verify flow rates via Inspector's Test Valve
- Check that the pump runs without undue vibration or overheating
- Check couplings and covers

Sprinkler Valves

- Check pressure gauges
- Check pressure switches
- Stop valves strapped/locked open
- Check operation of mechanical alarm gong

Protected Areas

- Sprinkler orientation (uprights/upright and pendants/pendant?).
- Distance of sprinkler from the ceiling (is it excessive?).



Water tanks should be inspected internally at 3/10 yearly intervals as appropriate for the specification

- Clearance of sprinklers from top level of storage (at least 1m).
- Obstructions, particularly important on suppression mode sprinklers
- For in-rack protection, heads correctly located in flues, particularly for higher hazard storage: flue spaces maintained and covered by the sprinklers?
- Is there adequate coverage under walkways, mezzanines, ducts etc?
- Pipe hangers and supports
- Wire cages around vulnerable heads
- Storage of spare sprinkler heads

Inspectors' Tests

All surveyors should know how to flow water from an inspector's test connection and to do that for each system they come across checking that:

- Water flows freely
- Alarm gong sounds within a minute,
- Alarm transmitted to remote location (if it is engineered to do so)
- (Not forgetting to notify the F&RS/Alarm Receiving Centre if they are connected!)

It's also essential to verify that the premises understand the requirements to be followed in the event of sprinkler impairment. Most insurers require that they are kept informed where it is necessary to impair any or all of a sprinkler system (for example by isolating water supplies) which may be necessary for maintenance or where a system is being extended. Insurers will advise on precautions to be taken during the impairment which invariably will include the need to suspend cutting, welding and other hot work. They will also typically follow-up to ensure protection is restored once work is complete. These procedures should also include the notification of the local fire and rescue service and are covered in Annex J of BS EN 12845 and LPS 203.6. Helpful guidance will also be found in BAFSA Information File 27 *Sprinklers and the Building Occupier* (to be published in 2015).

Deluge systems should be tested where possible to verify full coverage

Presented by

bafsa

British Automatic Fire Sprinkler Association
Richmond House, Broad Street, Ely, Cambridgeshire CB7 4AH
Tel: 01353 659187 Fax: 01353 666619
Email: info@bafsa.org.uk Web: www.bafsa.org.uk