Fire Suppression
in
Schools
and
other
Local Authority Buildings

A Best Practice Guide

March 2011
One of the main initiatives introduced by the Welsh Assembly Government recently in collaboration with the Welsh Local Government Association is the 21st Century Schools Programme, which is a long-term major investment Programme for maintained schools. The aim of the Programme is to deliver world-class school environments for all young people in Wales, ensuring the school environment is adaptable, sustainable, inclusive and a resource the whole community can use. School buildings should be places that inspire both learners and teachers, accommodate 21st Century technology and be adaptable to meet the changing needs of learners.

The Consortium of Local Authorities in Wales (CLAW) has been asked to investigate and report upon various projects for 21st Century Schools. One of these projects is to prepare a Sprinkler and Fire Suppression System Guide to be used for the Welsh Assembly Government’s 21st Century Schools Programme. CLAW welcomes the opportunity of being asked to assist with the 21st Century Schools Programme. CLAW supports the professional and technical interests of property management in local government in Wales and its main objectives include:

- To promote and support joint working between member authorities and other organisations.
- To promote excellence in the management of property assets, delivery of projects and provision of property services in Welsh local government.
- To support member authorities through the provision of training, dissemination of best practice, production of standard documentation and commissioning of research.
- To represent the interests of member authorities through the establishment of links with the Welsh Assembly Government and other organisations.

A considerable amount of research has gone into the preparation of this guide, including help from the Fire Service College, Zurich Insurance, Tyco, Ultra Mist, IPS and Building Control Wales. I am thankful for this assistance and also for the work undertaken by colleagues in the CLAW Mechanical and Electrical Group and by Marald Engineering Consultants in drawing the document together.

In working closely with the Welsh Assembly Government and the Welsh Local Government Association on the 21st Century Schools Programme, this is an excellent opportunity for CLAW to meet its broad objectives, to continue promoting collaboration and to produce a very useful guide for the benefit of its constituent member authorities.

Councillor Keith Evans – Ceredigion CC
Chair of the CLAW Members’ Executive
Consortium of Local Authorities in Wales (CLAW)

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Editorial Sub-Group
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Mike Hughes, North Wales Police and North Wales Fire and Rescue

Members
Members of the CLAW Mechanical and Electrical Group
Ron Thomas Marald Engineering Consultants
Phil Shone Marald Engineering Consultants
PREFACE

About this guide

This guidance has been commissioned by the 21st Century Schools programme team based at the Welsh Local Government Association (WLGA) for Technical Officers in local authorities in Wales to use for the design, installation, commissioning and maintenance of Fire Suppression Systems within Authority property, but specifically in the build and refurbishment of schools.

Fire Suppression in Schools

Automatic sprinkler systems are used more than any other fixed fire protection system and over 40 million sprinklers are fitted world-wide each year. Sprinkler systems have been proven in use for well over 100 years. Possibly the oldest in Britain was fitted in 1812 at the Theatre Royal Drury Lane and updated form is still in use today.

Losses from fires in buildings protected with sprinklers are estimated to be 1/10 of those in unprotected buildings.

In buildings fully protected by sprinklers:

- 99% of fires were controlled by sprinklers alone.
- 60% of fires were controlled by the spray from no more than 4 sprinklers.

On average, each year in the UK there are around 2,000 fires in schools and educational establishments and, while over the past decade there have fortunately been no deaths in any of these fires, they are responsible for an average of more than 30 injuries per year.

The direct cost of school fires is constantly rising and estimated currently to be in the region of £100 million per annum. However, when uninsured and social costs are taken into account e.g. loss of coursework, teaching aids, community facilities etc, the true cost is far higher.

But above all, the disruption and damage to children’s education is immense and something that cannot, if ever, be easily replaced.

The Welsh Assembly Government has taken positive action to address this issue. Access to their deliberations and policies can be found on their website. A link can be found in the appendix to this document.

In line with Welsh Assembly Government policy that where grant is being provided for the investment in new school buildings or significant refurbishment the Grantee will be required to install fire sprinklers. (Part B of the regulations refers to fire safety and applies to all new school buildings, major refurbishments and extensions.
Acknowledgements

CLAW and Marald Engineering Consultants are most appreciative of the generous help given to them in the preparation of this document by

- Welsh Assembly Government
- Welsh Local Government Association
- 21st Century Schools
- Fire Service College
- Zurich Risk Engineering UK
- Tyco Fire & Integrated Solutions
- Ultra Suppression Systems Ltd
- IPS Flow Systems
- Building Control Wales
- Warrington Certification Ltd
- Firefighter Ltd.
- Staffordshire Fire and Rescue Service
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1.00.00 GENERAL

1.00.01 The purpose of this guide is to guide and assist local government officers, facilities managers, designers, commissioners and similar persons in respect of the requirements and practical considerations requiring the installation of fire suppression systems including automatic sprinkler systems and similar systems, for fire safety purposes.

1.00.02 The guide provides advice concerning:

• Deciding whether fire suppression is appropriate
• Deciding which form of suppression is most appropriate
• What information is required to assist in the design process
• Which parties need to be consulted
• The scope of the consultation necessary
• The appointment of suitable designers & installers
• Design, installation, commissioning and operation

1.00.03 Using this guide the Designer should be assisted in making appropriate decisions to ensure cost effective installations.

1.01.00 FORMAT

1.01.01 This guide is divided into a number of parts:

• Part 1 – Scope of the Guide
• Part 2 – Fire Suppression Systems
• Part 3 - Early Consultation
• Part 4 – A Decision Model
• Part 5 – Pre-design Requirements
• Part 6 – Design
• Part 7 – Retrofitting Suppression

Cont’d
1.01.00 FORMAT (Cont’d)

1.01.01 Cont’d

- Part 8 – Installation and Commissioning
- Part 9 – Maintenance

1.01.02 Each part of the guide gives advice on what processes are required by a design team or facilities manager.

1.02.00 APPLICABILITY

1.02.01 This guide considers the use of fire suppression systems, such as sprinkler systems, to automatically detect and fight or control a fire as part of an engineered fire protection solution.

1.02.02 This guide is applicable to both new build and refurbishment projects.

1.02.03 In the main this guide considers the application of sprinklers in typical local government buildings such as

- Primary and Secondary Schools
- Colleges
- Offices
- Residential and Care Homes
- Houses in Multiple Occupation
- Domestic Housing
- Workshops and Similar Premises

1.02.04 This guide considers the application and use of various suppression systems including:

**Sprinkler Systems:**

- Wet installations
- Dry installations

Cont’d
1.02.00 APPLICABILITY (Cont’d)

1.02.04 Cont’d

Water Mist Systems

- High pressure water mist systems
- Low pressure water mist systems

Gaseous Suppression Systems

- Halon replacement gas systems and similar
- Oxygen depletion gas systems (CO₂, Argon etc.)

1.03.00 EXCLUSIONS

1.03.01 This guide is not intended to be a detailed design manual. The design of suppression systems is a specialist function which must be carried out by suitably qualified and competent persons.

1.03.02 Other than for general guidance, this guide does not give detailed advice on specialist areas such as:

- Manufacturing or production areas with specific fire control requirements
- IT machine rooms
- Archives stores
- Industrial storage areas
- Underground car parks

1.03.03 If guidance is required for these or similar areas, specialist advice should be obtained.

1.03.04 Guidance is not considered for:

- Pre-action installations
- Recycling installations
- Deluge installations
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1.00.00  INTRODUCTION
2.01.00  SPRINKLERS
3.02.00  WATER MIST
4.03.00  GASEOUS
2.00.00 INTRODUCTION

2.00.01 The following clauses outline the alternative methods of fire suppression to be considered.

2.01.00 SPRINKLERS

2.01.01 Automatic sprinkler systems have been in use since the early 19th century. The technology is proven and widely understood.

2.01.02 In simple terms a conventional automatic sprinkler system consists of pipes and heat sensitive sprinkler heads connected to a water supply. Fire is detected by an individual sprinkler head which opens to release water, in the form of a spray, to the seat of the fire.

2.01.03 The release of water activates an alarm so that the fire is controlled by the water spray until the arrival of the fire and rescue service.

2.01.04 Modern developments have improved the thermal performance and aesthetic qualities of the sprinkler heads, but fundamentally modern systems are identical to those of the 19th century.

2.01.05 Because of design requirements and infrastructure constraints, such as possible insufficient pressure and flow from the mains water supply, there is usually a requirement for large water storage tanks with duty and standby pumps. This can have significant cost consequences to an installation.

2.01.06 However, the installation of sprinklers can significantly reduce damage in the event of a fire and minimise disruption to service delivery, whilst also serving to protect Fire fighters and prove to be of benefit to the environment.

2.01.07 Insurance companies may recognise the installation of sprinklers to approved standards in terms of reduced premiums and excesses.

2.02.00 WATERMIST

2.02.01 As the name implies, water mist systems deliver water in very small droplets. The mist suppresses fire by a combination of cooling plus steam smothering and oxygen depletion at the flame front. It stops the spread of fire by blocking radiant heat transfer, and it also cools and, to some degree, washes harmful smoke particles out of the air.

Cont’d
2.02.00 WATERMIST (Cont’d)

2.02.02 Water mist systems have been available for many years. However, in the main within the UK, these systems have been used for specialist and restricted applications e.g. deep fat fryers, data processing areas, industrial equipment, cable tunnels, etc.

2.02.03 A principal feature of all water mist systems is the relatively low quantities of water used compared to other water based fire fighting systems, with consequent low levels of water damage and post-operation clean up.

2.02.04 A consequence of these characteristics is that the volume of water storage for a given application can be significantly reduced with the attendant cost savings.

2.02.05 Water mist systems, therefore, are seen as an attractive option for fire suppression within residential and domestic applications, schools, offices, archive stores, etc.

2.02.06 Currently there are no published approved standards for the installation of water mist systems, although the British Standards Institution has published two Drafts for Development (one of which has restricted circulation and has not yet been formally issued).

2.03.00 GASEOUS

2.03.01 Gaseous systems are those in which the fire extinguishing agent is applied in a gaseous form. They are an effective means of attacking fires in electrical risks such as server rooms, communications rooms, archives or records stores, as well as flammable liquid fires in plant enclosures and stores.

2.03.02 The objectives of gaseous systems are to extinguish the fire, limit the spread of fire, prevent re-ignition and enable quick reinstatement of operations. As a consequence, gaseous systems limit smoke generation and minimise post fire clean up.

2.03.03 There are a number of gaseous agents that are available in the UK. Reference should be made to the latest guidance from DEFRA when selecting agents. All agents must have zero ozone depletion potential (refer to the link in the Appendix to this document).

2.03.04 Gaseous fire suppression systems require strict design criteria concerning detection systems and room integrity. Design is a specialist function.
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3.00.00 PURPOSE

3.01.00 REQUIRED INFORMATION

3.02.00 SCOPE OF CONSULTATION
3.00.00 PURPOSE

3.00.01 Appropriate and timely consultation can have significant cost benefits with regard to fire suppression systems.

3.00.02 Without appropriate consultation there is a possibility that decisions regarding water storage, hazard classification, system choice, etc., may be inappropriate resulting in significant and unnecessary project costs.

3.01.00 REQUIRED INFORMATION

3.01.01 The following information should be provided to interested parties as an essential element of the consultation process:

- Proposed occupation and use of the building
- Fire engineering management proposals
- National policies and guidelines
- Local policies and guidelines

3.01.02 The following key points should be obtained as an outcome of consultation:

- Insurance company policies, guides and requirements. It should be noted that these differ between companies and projects, particularly with respect to water storage stipulations and hazard classification.
- Local fire and rescue service policies, guides and requirements and in particular the consequences of their Integrated Risk Management Plan.
- Project and/or property design proposals including outline construction information.
- Business continuity plans.
3.02.00 SCOPE

3.02.01 Appropriate consultation is required at an early stage with:

- **Client/End User:**
  
  Proposed operation and use can have significant affects on the classification of risk associated with a project. It is essential to understand the proposed occupation patterns and operation to ensure that the selected suppression systems are appropriate. It is for the Client/End User to advise whether their primary requirement of a fire suppression system is for property protection or for life safety protection.

- **The Insurer:**
  
  Insurance Companies operate different standards that they are prepared to accept in order to reflect the presence of suppression within insurance premiums and excesses. Early consultation is essential to ensure that the proposed fire engineering solution will meet the requirements of the Insurer as referred to in Clause 3.01.02 of this document.

- **The local Fire and Rescue Service:**
  
  Response times will be dependent upon the location and status of the nearest fire station. Similarly fire fighting practice will be dependent upon whether life is at risk. These issues will affect the operating time required of the suppression system. Such issues can significantly change the required stored water volume and hence cost.

- **Building Control**
  
  Building Control has the responsibility to ensure that the fire management proposals are appropriate to the proposed scheme. Early consultation can provide suitable solutions for many issues concerning, for example, escape routes, compartmentation, etc.

- **Water Supplier**
  
  Early consultation with the water supplier is essential to ensure that the network infrastructure is in place. Flow rate and pressure can affect decisions regarding the provision and size of water storage.

Cont’d
3.02.00 **SCOPE** (Cont’d)

3.02.01 (Cont’d)

- Manufacturers/suppliers/trade organisations

Technology associated with fire suppression continues to develop and evolve. When considering a project involving fire suppression it is essential to consult with manufacturers and installers to ensure that the most cost effective solution is considered at the earliest stage.
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4.00.00 PROCESS

4.00.01 This decision model is designed to assist in the process of deciding whether a fire suppression system is required or not, and what the most appropriate system should be.

4.00.02 It should be considered as an aide within a rational decision process. It is intended to assist the design team through the decision process. It is unlikely to provide a simplistic yes/no answer.

4.00.03 Serious consideration should be given to the long term environmental benefits of sprinklers and also the crucial subject of Fire-fighter safety should be taken into account.

4.00.04 If the model suggests that sprinklers are required then it will assist with design stage processes.

4.01.00 REQUIRED INFORMATION

4.01.01 The following information should be considered as an essential element within the decision process:

- National policies and guidelines
- Local policies and guidelines
- Insurance company policies, guides and requirements
- Local fire and rescue service policies, guides and requirements and in particular the consequences of their Integrated Risk Management Plan
- Project and/or property design proposals including outline construction information
- Nature of occupancy and proposed use patterns and structures
- Business continuity plans

4.02.00 DECISION MODEL

4.02.01 The following flow chart is provided to assist with the decision process:

Cont’d
STAGE 1: NATIONAL POLICY

Consideration should be given to the influence of National Policies. In Wales these may be primarily from the Welsh Assembly Government although consideration should be given to guidance from the Department for Children, Schools and Families, Department of Communities and Local Government, etc. In Wales the Welsh Assembly Government policy is that where grant is being provided for the investment in new school buildings or significant refurbishment the Grantee will be required to install fire sprinklers. (Part B of the regulations refers to fire safety and applies to all new school buildings, major refurbishments and extensions).

STAGE 2: LOCAL POLICY

Many local authorities have local policies regarding the installation of sprinklers. These may be supported by other groups such as the Welsh Local Government Association.

STAGE 3: FIRE RISK ASSESSMENT

A fire risk assessment, even at an early stage within the design process, will consider life and property risks.

The role of the fire risk assessor is crucial to achieving cost effective solutions to satisfy both Insurers and Building Control Officers.

Particular consideration should be given to the worst possible attendance time of the local Fire and Rescue Service.

The Integrated Risk Management Plan of the Fire and Rescue Service should be examined to determine their fire fighting policies.
STAGE 4: ASSESS FUNCTION OF PROTECTION

Consider the function and use of the building and in conjunction with the fire risk assessment and the insurers ascertain whether the primary function of the fire suppression system is one of life protection or property protection.

STAGE 5: COST BENEFIT ANALYSIS

Undertake a cost/benefit analysis.

For schools a suitable model cost benefit analysis is available from the DCSF and in BB100.

This, or similar models, should be used in a modified format, for other types of premises.

Guidance concerning Capital Costs and Whole Life Cost models can be found in DCSF document SSLD8: Sprinklers in Schools.

After following the requirements of Stages 1 to 4, the option appraisal may indicate that a fire suppression system is unnecessary. In that case alternative fire precautions should be employed in accordance with BS 9999: 2008 or the Building Regulations and Approved Document B

Otherwise proceed to Stage 6.

STAGE 6: DEFINITION OF APPROPRIATE STANDARD

If after undertaking the previous stages, there is a requirement for installing sprinklers, then the appropriate standard for the installation should be decided.

For Primary and Secondary Schools, offices, stores, larger residential homes and complexes then a commercial standard will be applicable.

Domestic/residential standards may be suitable for HMOs, small offices, domestic properties, small residential homes, etc.
STAGE 7: PRE-DESIGN INFORMATION

Collate all information required prior to design stage. Check with appropriate British Standard (or other national standard) for list of required information.

Guidance concerning Hazard Classification and water supplies and storage can be found in DCSF document SSLD8: Sprinklers in Schools.

STAGE 8: APPOINTMENT OF DESIGNER

Appoint an appropriate designer who can demonstrate appropriate insurance cover and competence by means registration with a Third Party Certification Scheme such as the LPCB scheme or the Warrington Certification Ltd scheme.

It may be that at this stage the designer, checker and installer are appointed as a single corporate body. In that case adequate safeguards should be employed to ensure that the most appropriate systems and designs are provided. An independent third party (such as The Fire Service College) should be used as appropriate.

STAGE 9: DESIGN PROCESS

The design process will involve the whole design team.

It is essential that the design of the sprinkler system matches the building concept and proposed use patterns.

A list of required information is included within the appropriate British Standard.

Other aspect of the design (e.g. size of compartments, escape routes and fire fighting shafts) should be adjusted to reflect the sprinkler provision.

It should be ensured that all design layout drawings are prepared utilising a proprietary CAD package and that all information is electronically transmitted.
STAGE 10: DESIGN CHECK

Ensure that all aspects of the building design and sprinkler design are checked for compatibility.

Carry out a full co-ordination exercise to ensure no clashes of sprinkler pipework occur with any of the building elements or other mechanical and electrical services.

Checks should also be made to ensure that the discharge from sprinkler heads will not be masked in any way.

Use a third party specialist to examine and check the design of the sprinkler installation.

Refer to the Fire Risk Assessor to ensure that the proposed design solution meets the requirements of the project’s fire management plan.

STAGE 11: APPOINTMENT OF INSTALLER

It is frequent practice that the designer and installer are one corporate body. In that case the installer will have been appointed at the same time as the designer.

Where a different installer is appointed they must be able to demonstrate competence by means registration at an appropriate level with a Third Party Certification Scheme. This may be the LPCB scheme or the Warrington Certification Ltd scheme.

STAGE 12: SUPERVISION OF INSTALLATION

An independent quality check by a suitable competent person is essential to ensure that the installation is carried out to the required specification and standards.

The installation shall be monitored to ensure that the issued design drawings are strictly adhered to and deviations which prove necessary, for whatever reason, are noted and the drawings re-drafted to ensure that the flow and discharge rates may be checked.
### STAGE 13: INSPECTION, TESTING AND COMMISSIONING

Prior to handover the whole installation should be inspected and thorough commissioning tests undertaken.

All test results should be compared to the design and fully documented.

The documentation shall include the updated drawings which shall include, in an agreed format, the recorded flow and discharge rates.

All inspection, commissioning and testing should be witnessed by the Client’s agent (and when necessary by the Insurer’s representative).

### STAGE 14: HANDOVER

A detailed list of the information required at handover is included within the appropriate British Standard (refer to the link in the Appendix to this document).

This information should be included within an appropriate Operations and Maintenance Manual and shall include a system log book to record all future system operation, maintenance, repair and modification.

The handover process should include for initial operator training.

### STAGE 15: OPERATION AND MAINTENANCE

It is common practice that the installer is appointed as the maintenance contractor.

In this case care should be employed in the methodology used to cost long term contracts. It is recommended that the appropriate BERR Cost Indices are used for annual contract cost adjustment.

Inspection and maintenance should be carried out to an appropriate specification by competent contractors.
Competence should be demonstrated by means of the appropriate quality control requirements of the Third Party Certification Scheme.

Clients and building operators should review the system regularly (annually) so that any operational changes are reported to the maintenance company and the effectiveness of the sprinkler system reviewed.

Refresher training for operators should be carried out at appropriate intervals.

It should be noted that the monitoring of systems in respect of the control of legionella may be carried out by an alternative specialist contractor.
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5.09.00 AESTHETICS OF INSTALLATION
5.10.00 EFFECTS ON OTHER DESIGN ISSUES
5.11.00 STANDARDS AND SPECIFICATIONS
5.00.00 GENERAL REQUIREMENTS

5.00.01 For fire suppression systems to operate successfully the systems need to be designed, installed and maintained to a high standard. The systems may not be required to operate for many years, but always need to be ready to do so.

5.00.02 There are fundamental decisions required of the design team prior to the commencement of the detailed design process.

5.00.03 As outlined in Part 3 detailed consultation is essential at the earliest stage of the process. This consultation will assist in ensuring that the most appropriate suppression system is selected in terms of:

- Effectiveness
- Reliability
- Installation cost
- Maintenance and operational cost

5.00.04 It should be recognised that decisions regarding the provision and extent of a fire suppression system will have an effect on other aspects of a project design.

5.00.05 Other fire control measures required by the Building Regulations and Approved Document B may be changed and or relaxed consequent to the provision of a sprinkler system. Alternatively the standard applied may be BS 9999:2008 or BS 7974: 2001, in which case a fire engineered solution is the most appropriate.

5.01.00 APPROPRIATE STANDARDS - SPRINKLERS

5.01.01 There are a number of British, European and other national and industry standards for automatic sprinkler systems that may be applicable. Consultation with the Insurer and other interested parties is essential at an early stage to ensure that the appropriate standard is used in the design process.

Cont’d
5.01.00 APPROPRIATE STANDARDS – SPRINKLERS (Cont’d)

5.01.02 For residential and domestic systems the current applicable British Standard is:

BS 9251:2005 Sprinkler systems for residential and domestic occupancies – Code of Practice.

5.01.03 For other and more complex installations the current applicable British Standard is:


5.01.04 The requirements of BS EN 12845:2004 +A2:2009 are more complex and stringent than those of BS 9251:2005.

5.01.05 BS EN 12845:2004 +A2:2009 will be applicable to:

Primary and Secondary Schools
Larger care and residential homes
Colleges
Offices
Workshops
Stores, etc.

5.01.06 Within the local authority sector it is probable that BS 9251:2005 will apply to:

Domestic houses
Houses in multiple occupation
Care and residential homes

5.02.00 APPROPRIATE STANDARDS – WATER MIST

5.02.01 The technology associated with water mist fire suppression systems is less well proven within the United Kingdom and currently there are no published or approved British Standards.

5.02.02 Draft British Standards for fire testing of systems have been published, and if these are considered as appropriate and acceptable to Insurers and other parties, may be considered for use.

Cont’d
5.02.00  APPROPRIATE STANDARDS – WATER MIST (Cont’d)

5.02.03  For Primary and Secondary Schools, colleges, industrial and commercial systems, the applicable British Standard Draft for Development is:


At time of publication of this document this standard has not been formally issued and has restricted circulation.

5.02.04  For residential and domestic systems the applicable British Standard Draft for Development is:


5.02.05  Other non-UK test standards are available and may be considered as appropriate to an installation. These standards include VdS CEA 4001, NFPA750 and IMO 800. The application of such standards should only be considered after detailed consultation with insurers, manufacturers, installers and other interested parties.

5.02.06  Current technology available in the United Kingdom is such that it is particularly important that any water mist system has ‘test evidence as a system’ certification rather than purely certification of component elements. All systems should have been subject to appropriate and relevant fire testing.

5.03.00  APPROPRIATE STANDARDS – GASEOUS SYSTEMS

5.03.01  Use of gaseous fire suppression systems is generally limited to specialised areas (such as server rooms, archives stores, etc.). For such applications specialised advice is required.

5.03.02  The Standards associated with gaseous systems include:

BS ISO 14520:2000 - 2006
BS EN 15004:2008
BS 5306 Part 4:2001
NFPA 2001
CEA 4008
5.04.00 LIFE AND/OR PROPERTY PROTECTION

5.04.01 In simple terms an automatic sprinkler system consists of pipes and heat sensitive sprinkler heads connected to a water supply. Fire is detected by individual sprinkler heads which open to release water, in the form of a spray, to the seat of the fire. The alarm is raised at the same time and the fire is kept under control until the arrival of the Fire and Rescue Service. Watermist systems operate in a similar manner but release water with much smaller droplet size.

5.04.02 The principal role, therefore, of automatic sprinkler or watermist systems is one of property protection.

5.04.03 However, in some properties and circumstances, (e.g. Houses in Multiple Occupation) automatic sprinkler or watermist systems may be classified as part of an engineered approach to life protection.

5.04.04 It is essential that the purpose of the proposed fire suppression system is identified at the earliest stage.

5.04.05 If a sprinkler or watermist system is designated for life protection, then the specific requirement that applies must be considered within the detailed design process.

5.05.00 HAZARD CLASSIFICATION

5.05.01 In order to match the capability of an automatic sprinkler system with the type of risk with which it will have to cope, the risks are grouped into hazard classifications.

5.05.02 BS 9251:2005 defines two divisions:

- Domestic Occupancy
- Residential Occupancy

5.05.03 Within BS EN 12845:2004 +A2:2009 there are three main divisions:

- Light Hazard
- Ordinary Hazard
- High Hazard

Cont’d
5.05.00 HAZARD CLASSIFICATION (Cont’d)

5.05.04 Hazard classification will dictate the minimum amount of water which must be provided at the fire in the form of a spray. This is normally expressed as the ‘design density’.

5.05.05 The expected maximum area of the sprinkler system which will be activated by the fire is also dictated and this is known as the ‘assumed maximum area of operation’.

5.05.06 The ordinary and high hazard classes are sub-divided to further qualify the type of risk.

5.05.07 Detailed guidance concerning hazard classification for schools can be found in DfE document SSLD8: Sprinklers in Schools and in Section 6 and Annex A of BS EN 12845:2004 + A2:2009.

5.05.08 Light Hazard

Depending upon detailed consideration, certain areas of Primary and Secondary Schools may be considered light hazard.

Low fire loads with low combustibility and no single compartment greater than 126m² with a fire resistance of at least 30mins. The maximum protected area for LH is 10,000 m² per control valve.

Note: This classification depends upon the size of the fire being very limited. No areas of storage are permitted within this classification. In practice these limitations are very restricting and consequently many risks initially classified as light hazard will be re-classified as ordinary hazard.

5.05.09 Ordinary Hazard

Ordinary hazard risks will be commercial and industrial occupancies involving the handling, processing and storage of mainly ordinary combustible materials. The classification is further sub-divided into:

- Ordinary Hazard Group I
  
  Typically: Schools (certain areas), cement works, sheet metal product factories, abattoirs, dairies, hospitals, hotels, libraries (excluding book stores), restaurants, offices.

- Ordinary Hazard Group II
  
  Typically: photographic labs, bakeries, breweries, car parks, museums.

Cont’d
5.05.00 HAZARD CLASSIFICATION (Cont’d)

5.05.09 Ordinary Hazard (Cont’d)

- Ordinary Hazard Group III and Group III special

  Typically: industrial processes and buildings with a high combustible load.

5.05.10 High Hazard

High fire load and high combustibility. High hazard categories are typically storage facilities where racking is used and chemical processes.

5.05.11 Premises may contain a combination of different risk classifications. Detailed consultation is required with the Insurer and Fire Authority.

5.05.12 Watermist systems

The concept of ‘hazard classification’ has not been included within the BS Drafts for Development for watermist systems.

5.05.13 In both DD 8489 and DD 8458, Clause 6 requires that the design of the system should be based upon proven test data regarding the effectiveness of the system under comparable test conditions.

5.06.00 EXTENT OF SPRINKLER PROTECTION

5.06.01 Sprinkler protection should be as extensive as possible.

5.06.02 Areas without sprinkler protection should be adequately separated from sprinklered areas. These areas may be lost in the event of a fire.

5.06.03 Where it is appropriate to leave areas unprotected by sprinklers, then alternative provisions of automatic fire detection should be made.

5.06.04 Sprinklers should be installed in all areas of the building; although it is permissible to exclude sprinklers in certain locations: e.g. toilets/washrooms of non-combustible materials; enclosed staircases not containing combustible materials. Sprinklers should be installed in roof, ceiling and floor voids in accordance with the detailed requirements of Clause 5.4 of BS EN 12845:2004 + A2:2009.

Cont’d
5.06.00  EXTENT OF SPRINKLER PROTECTION (Cont’d)

5.06.05 Excluded areas should include electrical switch rooms, IT server and machine rooms, etc. In such locations specialist fire suppression methods are required and further specialist design advice should be sought within the context of the fire management plan.

5.07.00  TYPE OF SPRINKLER SYSTEM

5.07.01 The method of feeding the water supply to the sprinkler heads, the control of that supply and the method of raising the alarm are detailed design issues which must be appropriate to the type of risk, its location and its environment. There are various types of system:

- **Wet Installations**
  Wet installations are the simplest, most reliable and hence most common systems. The entire system pipework is charged with water under its supply pressure and in the event of sprinkler head operation the water is discharged immediately.

- **Dry Installations**
  Dry installations should only be considered for areas where a wet installation cannot be used. (e.g. cold stores)

  The disadvantage of this type of system is the potential delay between sprinkler actuation and the arrival of water to the fire area. This potential delay must be considered as part of the detailed design process

5.07.02 Other types of installation exist which are **not** considered within the context of this guide. These include:

- Pre-action installations
- Recycling installations
- Deluge installations

5.07.03 Should any of these systems be considered necessary then further specialist design advice should be sought within the context of the fire management plan.
5.08.00 WATER REQUIREMENTS

5.08.01 Detailed consultation with the local water supply company is essential.

5.08.02 The provision of adequate water supplies is a detailed design issue and further detailed guidance is provided in section 9 of BS EN 12845:2004 + A2:2009 or section 8 of DD 8489-1:2009.

5.08.03 Water supplies need to be capable of providing the required flow rates for the system and should have sufficient capacity to ensure that the sprinklers can remain in operation for the periods required by the hazard classification.

5.08.04 Water supplies can be town mains, storage tanks, pressure tanks and inexhaustible sources.

5.08.05 There are a number of examples of innovative water supplies that may be considered. These include:

- Swimming pools
- Adjacent lakes, canals or rivers
- Rain water harvesting systems
- Grey water harvesting systems

5.08.06 If such systems are considered within the design process, it is essential to consider issues of the suitability, reliability, volume and continuity of supply at all times. Additionally cleanliness or contamination may present issues and specialist advice may be required.

5.08.07 There may also be safety and operational issues concerning the sudden removal of large quantities of water from such sources of supply.

5.08.08 It should be noted that if certain conditions are met (e.g. guaranteed response time by the FRS), then it is possible to reduce total water stored volume. Early consultation with the Insurer and FRS is essential.

5.08.09 In the vast majority of installations a storage tank will be required. Further guidance concerning the requirements for storage tanks is provided in section 9 of BS EN 12845:2004 + A2:2009.

Cont’d
5.08.00 WATER REQUIREMENTS (Cont’d)

5.08.10 In some instances external surface water storage tanks may present planning issues. In such cases underground storage tanks may be considered. In order to conform to the requirements of BS EN 12845:2004 + A2:2009, these should be constructed of concrete and comply with Code of Practice BS 8007:1987. Further detailed guidance concerning size and suction lift is provided in section 9 of BS EN 12845:2004 + A2:2009.

5.08.09 All approved sprinkler tanks need to comply with LPS 1276. Reference to the tanks is made in Technical Bulletin 224 2009:1.

5.08.10 A Certificate of Conformity can only be issued if these criteria are met.

5.08.10 It should be noted that other forms of underground tanks have been used, such as those manufactured from GRP. These tanks are not LPCB approved and a certificate cannot be issued. Additionally the maximum suction lift cannot always be achieved due to the size and covering required.

5.09.00 AESTHETICS OF INSTALLATION

5.09.01 Consideration of the aesthetics of the installation should be the role of the integrated design team in cognisance of architect, interior designer, building services engineer, structural engineer and the designer of the fire sprinkler system.

5.09.02 Sprinkler heads are a crucial element in any sprinkler system. They will act to both detect a fire and release water, in the form of a spray, and in appropriate quantities and spray characteristics to control the fire effectively.

5.09.03 The thermal response and spray pattern characteristic of the sprinkler head must be considered within the design process and be appropriate to the risk classification.

5.09.04 In many installations, for aesthetic reasons or as a means of combating vandalism, it may be desirable to use a flush, recessed or concealed pattern sprinkler head.

5.09.05 All recessed and concealed ceiling style sprinklers are likely to react more slowly to fire conditions. It is essential that this is a consideration of the detailed design process.
5.10.00 EFFECTS ON OTHER DESIGN ISSUES

5.10.01 The installation of automatic sprinklers in a new build or major refurbishment scheme should be considered as an element within a fire engineered approach and as such is a fundamental element of that scheme.

5.10.02 Other fire control measures required by the Building Regulations and Approved Document B may be changed and or relaxed consequent to the provision of a sprinkler system.

5.10.03 This is particularly applicable to issues and requirements concerning compartment size, horizontal and vertical escape routes and fire fighting shafts.

5.10.04 In some instances this can mean that the installation of sprinklers can be ‘cost neutral’ when considered within the context of the whole scheme.

5.11.00 STANDARDS AND SPECIFICATIONS

5.11.01 The design, installation and maintenance of sprinkler systems is a specialist area and should be entrusted to those who are competent to do so.

5.11.02 There are British and European Standards (as well as other national and industry standards) that are applicable and it is essential that these requirements are followed in detail (refer to the link in the Appendix to this document).

5.11.03 There are different requirements for schools, commercial and residential or domestic installations and the appropriate guidance should be consulted.

5.11.04 The DCSF’s publication “Standard specifications, layouts and dimensions 8: Sprinklers in schools” provides appropriate design standards for new schools.

5.11.05 Further reference is provided within the appendix to this guide.

5.11.06 In large or complex installations, where the provision of sprinklers is divided into a number of zones, the specification should include for a system to test individual zone flow switches.

5.11.07 Detailed consultation with the Insurer, local Fire and Rescue Service and Building Control authority is essential.

Cont’d
5.11.00 STANDARDS AND SPECIFICATIONS (Cont’d)

5.11.08 Should the proposed design deviate from the detailed requirements of the British Standard or the design guide occur then agreement to this deviation with the Insurer, local Fire and Rescue Service and Building Control authority is essential.

5.11.09 Exemplar projects and case studies are available on the BAFSA website (refer to the link in the Appendix to this document).
## INDEX TO CLAUSES

6.00.00 GENERAL  
6.01.00 APPOINTMENT OF COMPETENT DESIGNERS  
6.02.00 THE BRIEFING PROCESS  
6.03.00 CHECKING THE DESIGN  
6.04.00 CONSULTATION  
6.05.00 COORDINATION WITHIN THE BUILDING DESIGN  
6.06.00 CONSIDERATION OF LEGIONELLA CONTROL
6.00.00 GENERAL

6.00.01 This guide considers the principles of sprinkler design and application. It is not intended to act as a detailed design manual. Specialist advice should be sought whenever a system needs to be designed in cognisance of the fire management plan.

6.01.00 APPOINTMENT OF COMPETENT DESIGNERS

6.01.01 Voluntary schemes exist within the UK for the registration of sprinkler systems which are constructed to a recognised standard. These schemes are administered by the Loss Prevention Certification Board (LPCB) or Warrington Certification Ltd (FIRAS).

6.01.02 For Primary and Secondary Schools, industrial and commercial premises, whose installations conform to the requirements of BS EN 12845:2004 +A2:2009 the schemes are termed:

* LPS 1048: Requirements for Certificated Sprinkler Installers, Supervising Bodies and Supervised Installers.

* FIRAS Commercial & Industrial Sprinkler Systems.

6.01.03 For installations conforming to the requirements of BS 9251:2005 the schemes are termed:

* LPS 1301: Requirements for the approval of Sprinkler Installers in the UK and Ireland for Residential and Domestic Sprinkler Systems.

* FIRAS Residential & Domestic Sprinkler Systems.

6.01.04 Within LPS 1048, Contractors who work within the scheme are listed as either “Certificated”, and can issue their own certificates of conformity for projects, or “Registered Supervised” in which case their work needs to be supervised by the LPCB who will issue a certificate for the completed project.

6.01.05 Within the FIRAS schemes, Contractors can be Approved (i.e. supervised by WCL/FIRAS) or Certificated (self certifying). It is imperative that all works are within the competence of the appointed designer.

Cont’d
6.01.00 APPOINTMENT OF COMPETENT DESIGNERS (Cont’d)

6.01.06 It is essential that all designers, installers and maintenance contractors are listed in the LPCB’s “List of Approved Products and Services” or the FIRAS scheme’s Technical Directory of Certificated Fire Products and Services, Part 2. (also available as a web accessed data base – refer to the link in the Appendix to this document).

6.02.00 THE BRIEFING PROCESS

6.02.01 The briefing process should be well thought out, taking into account all possible requirements and constraints and should be thought of as a dynamic process rather than a ‘one visit’ solution.

6.02.02 The brief should include clear statements about property/life protection and the integration of fire suppression systems within the building fabric and with fire and security systems.

6.03.00 CHECKING THE DESIGN

6.03.01 It is implicit within BS EN 12845:2004 +A2:2009 that the design should be checked by a responsible person who is not the designer of the installation. This can be undertaken using a third party or another person within the contractor operating within the LPS or FIRAS scheme.

6.03.02 In all instances, the completed design should be submitted to the design team for approval with adequate information to demonstrate its compliance with the appropriate standards and the requirements of the Insurers, local Fire and Rescue Service and Building Control Authority.

6.03.03 The design information provided must include:

- Hazard classification to which the system is designed
- Details of proposed materials and installation methods
- Details of system components
- Design drawings – both layout and schematic in CAD format
- Sprinkler spacing and location
- Details of pipework systems including hydraulic calculations

Cont’d
6.03.00 CHECKING THE DESIGN (Cont’d)

6.03.03 Cont’d

• Details of proposed fixings and pipe supports
• Details of proposed water supplies with information regarding reliability, flow rate and capacity
• Full engineering specification for pump sets including pump performance curves
• Space requirements of water storage
• Details of the links to the building automatic fire detection and alarm systems and in particular the link to monitoring call centres, ensuring that all of these are in place
• Details of connections to other services including electrical supply requirements
• Coordination with other services

A complete list is included in section 4 of BS EN 12845:2004 + A2:2009.

6.04.00 CONSULTATION

6.04.01 The designer should be required to consult with all relevant parties including:

• The project team;
• The local Fire and Rescue Service
• The Building Control authority
• The local Water Supply Company
• The end user Client

6.05.00 COORDINATION WITHIN THE BUILDING DESIGN

6.05.01 Co-ordinate the whole of the sprinkler system with the building elements together with the mechanical and electrical services to ensure that potential clashes and obstructions are avoided.

6.05.02 As the building envelope design develops into it’s construction phase, ensure that the sprinkler system is amended to suit.
6.06.00 CONSIDERATION OF LEGIONELLA CONTROL

6.06.01 The requirements of HSE’s document L8: “The control of legionella bacteria in water systems” applies to automatic sprinkler systems and their associated storage tanks, pipework and ancillary equipment.

6.06.02 The system designer must provide a written risk assessment and provide details of proposed management and control systems to limit that risk during construction, installation, operation inspection and maintenance.

6.06.03 The requirements the Loss Prevention Council Technical Briefing Note “Legionella and Firefighting Systems” should be noted (refer to the link in the Appendix to this document).
INDEX TO CLAUSES

7.00.00 SCOPE
7.01.00 REQUIRED INFORMATION
7.02.00 DESIGN PROCESS
7.03.00 ASBESTOS
7.00.00 PURPOSE

7.00.01 This section of the guide provides some basic advice where fire suppression is being retrofitted in an existing building, either as a project or as part of a major refurbishment project.

7.01.00 REQUIRED INFORMATION

7.01.01 The following information should be considered as an essential element within the design process:

- The extent and purpose of the proposed fire suppression
- The existing fire protection systems within the building
- Proposed integration with other building and fire protection systems
- Structural and physical constraints
- Access

7.02.00 DESIGN PROCESS

7.02.01 The design process will be the same as has been outlined in this guide. Appropriate consultation, cost/benefit analysis, system selection, designer selection and contractor selection are fundamentally the same.

7.02.02 However the physical constraints imposed by an existing building structure may require careful consideration with the selection of system type and materials used.

7.02.03 Because of its limited flexibility and ease of application, CPVC pipework, can offer significant advantages in terms of installation and cost for retrofitting projects.

7.02.04 CPVC pipework should only be installed in strict accordance with the manufacturer’s guidelines. It can only be used on ‘wet’ systems and should not be used in areas where higher hazard conditions exist, such as in commercial kitchens, plant rooms or store rooms, factories or warehouses.
7.03.00  ASBESTOS

7.03.01  As with any other works undertaken in existing buildings it should be presumed that asbestos will be present.

7.03.02  Before undertaking any works, the asbestos register should be examined and a detailed refurbishment and demolition asbestos survey carried out in any area which is likely to be affected by the proposed works.

7.03.03  Further detailed guidance is available from the HSE.
INDEX TO CLAUSES

8.00.00 QUALITY
8.01.00 CO-ORDINATION
8.02.00 SUPERVISION
8.03.00 COMMISSIONING & TESTING
8.04.00 HANDOVER INFORMATION
8.05.00 CONTROL OF LEGIONELLOSIS
8.00.00 QUALITY

8.00.01 Contractors operating within the LPS 1048 scheme will also have been assessed to BS EN ISO 9001: 2008 Quality management systems.

8.00.02 Contractors operating within the FIRAS Commercial and Industrial scheme will also have been assessed to BS EN ISO 9001: 2008 Quality management systems.

8.00.03 All Contractors should be required to have:

- appropriate Professional Indemnity Insurance, to an appropriate level of cover, for the design aspect of their works, and
- appropriate Public Liability Insurance, to an appropriate level of cover, for their installation works.

8.00.04 Nevertheless, it is recommended that the works are supervised and inspected as a part of the normal project management process. Adequate supervision is essential, and should be carried out by an independent person who is competent and familiar with the latest industry practice.

8.01.00 CO-ORDINATION

8.01.01 Co-ordination of the sprinkler installation within the construction process is essential.

8.01.02 It is essential that the location and potential operation of sprinkler heads is not compromised by other services.

8.01.03 Similarly the final fix of sprinkler heads or concealing plates should be co-ordinated with decoration works.

8.02.00 SUPERVISION

8.02.01 Supervision of the installation is essential. Particular attention should be paid to:

- Installation methods
- Fixing of pipework and sprinklers
- Co-ordination with other services

Cont’d
8.02.00 SUPERVISION (Cont’d)

8.02.01 Cont’d

- Identification of services
- Installation of water storage tanks, pump sets, valves and associated equipment
- Relationship of the installation to other building elements or services that could have a detrimental effect to its operation (e.g. combustible roof linings that could ‘smother’ a sprinkler head)

8.03.00 COMMISSIONING & TESTING

8.03.01 In common with all piped services, proper commissioning and testing of the completed installation is very important. Unlike other piped services, the completed installation will not normally be tested in full operational mode therefore even greater care is required to ensure that the design objectives are met.

8.03.02 It is recommended that all commissioning tests are witnessed by the Client’s agent.

8.03.03 Full details of the commissioning and acceptance tests are detailed within Section 6 of BS 9251:2005, Section 19 of BS EN 12845:2004 +A2:2009, Section 7 of DD 8458-1:2010 and Section 11 of DD 8489-1:2009.

8.03.04 All commissioning and acceptance tests shall include:

- Dry pipework shall be tested to a pneumatically to a pressure of 2.5 bar for not less than 24 hours.
- Wet pipework should be tested hydrostatically to a pressure of 15 bar, or 1.5 times the working pressure, whichever is the greater, for a period of at least 1 hour.
- With chlorinated polyvinyl chloride (CPVC) pipe, the manufacturer’s recommendations and requirements should be followed.
- Dry systems should be tested to demonstrate response times to the most remote sprinkler head.

Cont’d
8.03.00 COMMISSIONING & TESTING (Cont’d)

8.03.04 Cont’d

- The capability of the water supply should be tested, through the complete range of its design requirements, to prove performance.

- Flow measuring devices shall be provided at the installation control valves and adjacent to pumps such that water flow and pressure can be measured accurately.

- In the case of diesel driven pump sets additional tests should be carried out to prove the automatic starting sequence.

- All alarms and alarm connections shall be tested.

- All links to remote monitoring locations shall be proved.

- All valve monitoring functions shall be proven.

8.03.05 Any non-compliant aspects of the installation shall be reported in the certification documentation.

8.04.00 HANDOVER INFORMATION

8.04.01 Full details of the commissioning certificates and documentation to be provided at handover are detailed within Section 6 of BS 9251:2005, Section 19 of BS EN 12845:2004 + A2:2009, Section 7 of DD 8458-1:2010 and Section 11 of DD 8489-1:2009.

8.04.02 Upon completion of the installation the following information should be handed over:

- Log book
- Full operation and maintenance manuals
- ‘As fitted’ drawings
- Schematic drawings
- Copies of all commissioning tests
- Test certificates for pneumatic and hydrostatic testing of pipework

Cont’d
8.04.00 HANDOVER INFORMATION (Cont’d)

8.04.02 Cont’d

- Details and test certificates regarding water supply testing
- Certificate of Conformity

8.05.00 CONTROL OF LEGIONELLOSIS

8.05.01 The control of legionella bacteria shall be considered throughout the installation and commissioning process.

8.05.02 All pipework shall be thoroughly cleaned and chlorinated.

8.05.03 The complete installation shall be chlorinated prior to commissioning.

8.05.04 Appropriate certification shall be provided.

8.05.05 The design risk management regime shall be commissioned as a part of the overall commissioning process.
INDEX TO CLAUSES

9.00.00  LOG BOOK
9.01.00  USER CHECKS & TESTS
9.02.00  MAINTENANCE SPECIFICATIONS
9.03.00  APPOINTMENT OF SPECIALIST CONTRACTORS
9.04.00  REPORTS
9.05.00  REVIEW
9.00.00 LOG BOOK

9.00.01 When the fire suppression system is handed over to the user a comprehensive operation and maintenance manual must be provided which should contain:

- Full documentation for the entire system, its components and all associated plant, alarms, utility supplies, etc., including record drawings (in both paper and electronic format).

- Information concerning the design parameters such as primary function, hazard classification, etc. (It should be noted that a change of use, layout or form of a building may have an effect on the suitability of the fire suppression system.)

- Instructions for day-to-day operation of the system and procedures to be adopted in and after fire conditions.

- A full schedule of all maintenance and testing required to keep the system in full working order.

9.00.02 It is essential that a Log Book is maintained for the system. The Log Book should record:

- all maintenance, inspection and testing
- all repair works
- as fixed drawings of alterations or additions
- copies of fire risk reviews

9.01.00 USER CHECKS & TESTS

9.01.01 When the system is handed over to the user, the installer must provide appropriate training to a nominated person (Caretaker, facilities manager/technician, etc.) to ensure that the user is fully conversant with the checks and tests necessary to keep the system in full working order.

9.01.02 This training should be repeated at appropriate intervals and upon change of responsible personnel.
9.02.00 MAINTENANCE SPECIFICATIONS

9.02.01 All cyclical maintenance, inspection and testing must be carried out in
strict accordance with the manufacturer’s and/or installer’s
recommendations and requirements.

9.02.02 The CLAW Maintenance Module 46 – Specification for Sprinkler
Maintenance, specifies a minimum standard for maintenance of sprinkler
systems (refer to the link in the Appendix to this document).

9.02.03 Appropriate maintenance for sprinkler systems will include a minimum of
service visits every 3 months for systems designed to BS EN 12845 +
A2:2009 and every 12 months for systems designed to BS 9251.

9.02.04 Appropriate maintenance for watermist systems will include service visits
every 3 months for systems designed to DD 8489 and every 12 months
for systems designed to DD 8458.

9.02.05 Where systems use concealed sprinkler heads, it is essential that a
clause is included within the maintenance specification to include an
inspection ensuring that head sprinkler performance has not been
compromised by painting or re-decoration works.

9.02.06 Sprinkler systems require a comprehensive inspection and test of the
system is required every 25 years. Further guidance is included within BS

9.02.07 Further guidance is available. Refer to the Appendix for further
information.

9.03.00 APPOINTMENT OF SPECIALIST CONTRACTORS

9.03.01 It is essential that all maintenance, testing and inspection works are
carried out by suitably qualified, experienced and competent contractors.

9.03.02 The LPS 1048 scheme (see Parts 4 & 5 of this guide) lists contractors
considered to be suitable for the maintenance of sprinkler systems.

9.03.03 The FIRAS scheme list contractors who are “approved” or “certificated”.
They operate a mandatory training requirement which includes
maintenance.

Cont’d
9.03.00 APPOINTMENT OF SPECIALIST CONTRACTORS (Cont’d)

9.03.04 The CLAW Maintenance Module 46 – Specification for Sprinkler Maintenance, specifies a minimum standard for certification of the maintenance contractor (refer to the link in the Appendix to this document).

9.04.00 REPORTS

9.04.01 Copies of maintenance reports should be retained within the system log book.

9.04.02 Maintenance reports should present a comprehensive report of all maintenance works including:

- visual inspections
- test results
- replacement items
- system condition
- recommendations

9.05.00 REVIEW

9.05.01 It is essential that systems and applications are regularly reviewed to ensure that the degree of protection is appropriate to the hazard classification.

9.05.02 Any material changes (for instance in stored materials or methods of storage) should be reported to the maintenance contractor (or original designer/installer).
There are many sources of useful information which should be consulted when considering installing sprinkler systems.

Amongst the more useful are the following:

**Legislation and Standards**

- The Regulatory Reform (Fire Safety) Order 2005
  [www.legislation.gov.uk](http://www.legislation.gov.uk)

- Welsh Assembly Government:
  [www.wlga.gov.uk](http://www.wlga.gov.uk)


**Specific Design Advice for Schools**

- Department for Education.
  Building Bulletin100: Design for fire safety in schools 2007

- Department for Education.
  Standard specifications, layouts and dimensions 8: Sprinklers in schools
General Design Advice

CLAW M&E Maintenance Specifications
www.claw.gov.uk

Loss Prevention Council Technical Bulletins

Publications by the Building Research Establishment
www.bre.co.uk

CIBSE Guide E Fire Engineering 2010

Other Useful Guidance

There are a number of websites which are worthy of reference, e.g.:

www.bafsa.org.uk
www.basa.org.uk
www.fireservicecollege.ac.uk
www.firesprinklers.info
www.warringtonfire.net
www.firefighter.ltd.uk