

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 1 of 19

1 INTRODUCTION

1.1 Benefits of the LPS 1048 scheme

Automatic sprinklers are installed in industrial, storage, commercial, retail, residential and domestic premises to safeguard life, property and the environment. Equipment designs and system configurations are continuously evolving. In order to ensure adequate protection, sprinkler system installers (hereinafter called Contractors) need an appropriate level of technical competency in both design and installation.

This scheme has been prepared by an Expert Group drawn from installers, local government, insurers and clients to help:

- Clients select contractors.
- Ensure that sprinkler systems are appropriate for the occupancy and/or hazard class of the premises in which they are installed, and will operate reliably in the event of a fire.

It has been approved by the LPC (Fire & Security) Board.

1.2 Technical Requirements

The technical requirements for industrial, storage, commercial and retail sprinkler systems installed in the UK are set out in the LPC Sprinkler Rules incorporating BS5306: Part 2: 1990 and the subsequently published Technical Bulletins.

The technical requirements for domestic and residential sprinkler systems are set out in DD-251 and LPC Sprinkler Rules, Technical Bulletin 14.

A full list of all the acceptable installation standards is given in Appendix 1.

This document, sets out the basis for approval of Contractors under this scheme including the levels of competence required for different classes of contract. It also defines the circumstances under which Contractors require supervision provided by an approved third party.

Key terms are defined in the glossary.

The LPCB is constantly seeking to improve the schemes it operates, not just technically but also in providing an excellent service and value to all of the scheme stakeholders. If you have any suggestions for improving this scheme please contact:

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BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 2 of 19

1.3 LPCB Listing

All Contractors approved by the LPCB to carry out design and installation of sprinkler systems will be listed in the LPCB *List of Approved Fire and Security Products and Services*, together with details of their approved scope.

This publication is available printed or on CD-ROM from the above address or on our web-site: www.redbooklive.com.

2. SCOPE

2.1 Scheme Structure

Four levels of approval are available as shown in Table 1 below.

TABLE 1

Work type	Approval level			
	1	2	3	4
Systems, installations, extensions and alterations involving pre-calculated design principles (excluding base build contracts)	✓	✓	✓	✓
Base build contracts (pre-calculated design principles)		✓	✓	✓
Systems, installations, extension and alterations involving FHC design principles			✓	✓

Progression from one approval level to the next higher level is by a combination of experience, assessment, review and examinations. In order to ensure and develop competence, supervision of work by a third party may be required. Table 2 summarises the requirements for approval at each level and further details are given in section 3 of this document.

Requirements for approval to carry out design and installation of domestic and residential systems to TB14 and BS DD 251 are being developed.

2.2 Application and Assessment

This scheme is open to all contractors operating in the UK and Eire.

Application forms are available from LPCB at the address above.

Contractors may enter the scheme at any level, subject to meeting the appropriate requirements. Approval will be granted following successful assessment by the LPCB.

Any listing awarded by LPCB remains valid only whilst the Contractor continues to meet the scheme requirements as defined in this and related documents.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 3 of 19

Where a Contractor operates design and installation work from more than one location, then separate approvals must be obtained for each. Regional offices undertaking only sales and/or emergency service work are not covered by this scheme.

2.3 Use of LPCB Marks

Details of how the mark may be used can be found in publication PN 103.

2.4 Change of Company Identity or Particulars

The Contractor should promptly notify the LPCB of any changes relating to their compliance with this scheme, including a change of company identity, legal entity, company registration and/or location. The Contractor shall notify any changes using publication PN 112.

2.5 Costs

All costs associated with LPS 1048 assessments, surveillance visits, special visits, supervision and certification are borne by the Contractor. Charges will be in accordance with the LPCB Schedule of Fees current at the time.

3. REQUIREMENTS FOR APPROVAL OF ALL CONTRACTORS

3.1 Installation Standards

Unless otherwise required by the Client, all sprinkler systems must be designed in accordance with the one of the installation standards listed in Appendix 1. Where the client's specification does not meet the minimum requirements of this scheme, the Contractor must not in any way claim or imply that the design or installation meets the requirements of this scheme and must not issue an LPS 1048 Certificate of Conformity.

3.2 Management System Requirements

In order to ensure that Automatic Sprinkler Installations meet and continue to meet the requirements of this scheme, Contractors are required to maintain full control of their design, pre-fabrication, installation, commissioning and maintenance processes through a management system approved by LPCB.

The management system will comply with either ISO 9001:2000 or ISO 9001/2:1994. However, Contractors who do not require LPCB ISO 9000 certification and listing will be assessed against ISO 9001/2:1994 until it is withdrawn in December 2003 and replaced by LPCB requirements for management systems.

Full details of our ISO 9000 certification process are set out in publication SD003 'Quality Management System Certification Scheme'.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 4 of 19

The duration and frequency of the Management System audit visits is typically one day twice per year. However the actual frequency and duration depends on a number of factors including size of company and scope of activities.

3.3 Contract requirements

Contractors will have satisfactorily completed a minimum number of projects or contracts in order to enable LPCB to carry out a full technical review and site inspection of a sample of these contracts. The minimum numbers and types of contract for each level are given below. For approval purposes, each contract must be assessed as satisfactory by LPCB against the requirements of this scheme.

Level 1

A minimum of 2 completed supervised pre-calculated sprinkler contracts.

Level 2

In addition to the requirements of Level 1, a further 8 completed supervised pre-calculated sprinkler contracts.

At least one supervised sprinkler contract with high hazard protection, one with town's main water supplies, one with pumped water supplies and one base build contract must be satisfactorily completed before the firm can self-certificate these specific types of contracts. (This condition may have been partially satisfied at Level 1.)

Firms may gain approval at Level 2 even if they cannot demonstrate their capability to undertake the full range of designs allowed under this level. The firm will be allowed to self-certificate work that they can prove their capability to undertake, but other work allowed under Level 2 must be fully supervised and their engineers must meet the qualification requirements of Table 2 by passing the relevant competence reviews.

Level 3

In addition to the requirements of Level 2, a minimum of 2 completed supervised FHC sprinkler contracts.

Level 4

In addition to the requirements of Level 3 the following contracts are required:

- 4 high hazard classification (*)
- 4 with superior or duplicate water supplies (*)
- 4 using fully hydraulically calculated design principles supervised by LPCB of which a minimum of two contracts must include intermediate in-rack protection (*)

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 5 of 19

(*) A minimum of 2 contracts of each type should be designed by currently employed designers. If this is not possible due to staff changes then evidence will be required that they have been replaced by other suitably qualified designers that meet the requirements of Table 2.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 6 of 19

TABLE 2

Approval Level	Limitations of work undertaken	Supervision and Issue of LPS 1048 Certificate of Conformity	Minimum number of technical staff	Qualifications	LPCB Surveillance Audits per year - duration
1	Pre-calculated contracts only, <u>excluding</u> all base build contracts	Supervision by LPCB Supervisory service or Supervising Body	1	Basic Design Review	LPCB One x 1 day Supervising Body Two x 1 day
2	Pre-calculated contracts only, <u>excluding</u> all base build contracts	Supervision not required, issue of LPS 1048 Certificate of Conformity by Contractor At least one supervised sprinkler contract with high hazard protection, one with town's main and one with pumped water supplies must be satisfactorily completed (as assessed by LPCB) before the firm can self-certificate these specific types of contracts. (This condition may have been satisfied at Level 1.)	2	Basic Design Review Pre-calculated Inspection Review	Three x 1 day
	Pre-calculated base build contracts	At least one supervised base build sprinkler contract must be satisfactorily completed (as assessed by LPCB) before the firm can self-certificate this type of contract.	2	Intermediate Design Review	
3	Pre-calculated contracts	Supervision not required, issue of LPS 1048 Certificate of Conformity by Contractor	2	Basic Design Review Pre-calculated Inspection Review Intermediate Design Review	Three x 1 day
	FHC	Supervision by LPCB Supervisory service only	1 of 2	FHC Design Review	
4	All work	Supervision not required, issue of LPS 1048 Certificate of Conformity by Contractor	2	Basic Design Review Intermediate Design Review FHC Design Review Pre-calculated Inspection Review FHC Inspection Review	Two x 2 days

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 7 of 19

3.4 Supervision

Approval to Levels 1-3 requires third party supervision where specified and the Contractor is expected to enter into a supervision agreement (SUP.F5) with one or more Supervising Bodies and/or the LPCB Supervisory Service (refer to Table 2).

The supervision process will be carried out in accordance with LPCB supervision procedure SUP.03. Table 2 gives details of the types of contracts that can be carried out and the supervision requirements for each approval level. Guidance note GN5/LPS 1048 gives details of which contracts require supervision.

Where a contract comprises work that requires supervision and work that the Contractor can self-certificate, the complete contract must be fully supervised.

3.5 Personnel, Training and Competency

All personnel employed (directly or by sub-contract) must be able to demonstrate that they are fully trained and competent in the disciplines and skills appropriate to their role. Complete records of training and competence skills of personnel must be maintained, in particular:

- Design staff that carry out full hydraulic calculations must be fully trained in the use of in-house computer hydraulic calculation packages.
- All personnel engaged in the installation of pipework are expected to have undertaken suitable training.
- All personnel engaged in the installation, testing and maintenance of specialist sprinkler equipment must be suitably trained.

Design Verification and Validation

Depending on their level in the scheme, the Contractor is expected to ensure that all designs are verified, and that all extensions, alterations, installations and systems are inspected by qualified technical staff. The minimum number of technical staff required is given in Table 2. The scope of the qualifications is as follows:

Qualification:	Covers:
Basic Design Review	Pre-calculated work including water supplies
Intermediate Design Review	Base build designs
FHC Design Review	Full hydraulically calculated designs
Pre-calculated Inspection Review	Inspection, testing and commissioning of contracts involving pre-calculated designs
FHC Inspection Review	Inspection, testing and commissioning of contracts involving fully hydraulically calculated designs

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 8 of 19

Note – The qualification requirements referred to in Table 2 may be waived up to 1st January 2007 where the Contractor can demonstrate to the satisfaction of the LPCB that the personnel employed have the necessary levels of competence. For further details refer to Guidance Note GN8/LPS 1048.

3.6 Competency Reviews

The competence review process, together with its associated examination formats, examination questions, model answers and marking regime are overseen by an examination panel.

The examination panel comprises technical experts drawn from various organisations, such as:

LPCB/BRE
The LPC Rules Steering Committee
ABI
Trade Organisation(s)

3.7 Sub-contracting

The Contractor shall be fully responsible for the work of their sub-contractors.

Where sub-contractors are used:

- The quality of their designs, materials, equipment or workmanship is to be to the same standard as that of the LPS 1048 approved Contractor.
- Service and maintenance activities will be carried out by directly employed personnel, or be sub-contracted to other LPS 1048 approved Contractors. Where specialist equipment and plant is involved e.g. fire pumps, suction tanks, trace heating, alarm/indicating systems, the service and maintenance may be carried out by the manufacturer, their authorised agents or specialist companies.
- All work undertaken by such sub-contractors is to be reviewed and verified by qualified staff directly employed by the Contractor to ensure that the requirements of the scheme are met. Records are to be maintained for all work sub-contracted.

3.8 Equipment

Where available, all specialist fire protection equipment used by the Contractor will be LPCB approved and procured directly from the manufacturer or his agent.

Training in the use and service of this equipment will be obtained from the manufacturer or his agent. All equipment will be used fully in accordance with manufacturer's instructions, its LPCB approval conditions, and the installation standard.

The Contractor should, where available, only use spare parts obtained from the manufacturers or their approved agents.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 9 of 19

3.9 Technical Data

The Contractor will:

- maintain current technical data, including specifications, installation, commissioning and service/maintenance instructions from all manufacturers of specialist fire protection equipment installed or serviced.
- make this information readily available to all necessary personnel, especially field operations staff.
- maintain computer software packages for hydraulic calculations to the version compliant with the installation standard in use.
- carry out and record standardisation checks for hydraulic calculation packages on each workstation, where terminals are independent of a central server.

3.10 Sprinkler Systems Inspection and Maintenance

The Contractor will provide an inspection and maintenance service to customers in accordance with the appropriate installation standard. The results of such inspections will be recorded and a copy provided to the building owner and/or occupier or agent.

The results of periodic testing will be compared with the original system requirements e.g. installation design flow rates, pump ratings, air pressures, in-fill rates, etc. to confirm that the system continues to provide protection commensurate with the occupancy and/or hazard class of the premises under review.

In the event that test results are found to be inadequate or that there are serious shortfalls in sprinkler protection, the Contractor shall notify the building owner and/or occupier or agent within 7 days. Examples of such serious shortfalls would be: change of hazard class, storage height not commensurate with density, unprotected areas, inadequate densities of discharge, pump performance shortfall, installation control valve un-serviceability, deterioration of town's main or pumped water supply etc.

3.11 Emergency Service

The Contractor will provide an effective 24-hour emergency service for customers to ensure that appropriate remedial action can be undertaken on site within 24 hours.

Service and maintenance engineers are to have access to a sufficient range of approved spare parts to resolve emergency call-out situations.

3.12 Maintenance of Certification

Certification of the Contractor is maintained by regular audits by LPCB to ensure that the requirements of the scheme continue to be met (see Appendix 2 for further details).

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 10 of 19

3.13 Contracts with Non-Compliances to the Installation Standard

Errors or omissions made by a Contractor during the execution of a contract are not acceptable and the Contractor must correct all such works.

A written agreement covering minor non-compliances with the installation standard shall be made between the Contractor and the owner/occupier (or his nominated representative) and all other authorities having jurisdiction (e.g. building control, fire safety officer and insurance company representatives). Only minor non-compliances will be documented on page 2 (schedule of non-compliances) of the LPS 1048 Certificate of Conformity.

Certificates of conformity may not be issued for any sprinkler system with a major non-compliance. In case of doubt, full details may be submitted to LPCB before any commitment is given to the possible issue of a Certificate (see GN3/LPS1048). Where significant work is required, LPCB may make an additional charge for this. Where a Certificate of Conformity cannot be issued, a System Report may be issued instead, if required by an interested party.

For contracts that are supervised, all non-compliances must also be agreed in writing with the Supervising Body.

3.14 Distribution of LPS 1048 Certificates of Conformity

This clause is to be read in conjunction with guidance notes GN3/LPS 1048 and GN4/LPS 1048.

LPS 1048 Certificates of Conformity will be issued to the following:

- The building owner/occupier (requiring their representative's signature)
- LPCB

and, where appropriate, secured to the installation control valve assembly.

Where required and agreed by the Client, copies of the certificate may be issued to:

- Building control
- Fire brigade
- Insurance Company

In the case of multi-tenancy buildings:

- a. The facilities management department or
- b. The Centre Manager (for shopping centres)

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 11 of 19

Copies of the certificate are to be retained by:

- a. The Contractor
- b. The Supervising Body / LPCB Supervisory Service

3.15 System Report

Where an LPS1048 Certificate of Conformity cannot be issued because of a major non-compliance, the Contractor may issue a System Report, if required by an interested party, which is expected to include a schedule detailing all of the non-compliances against the installation standard. The report must not attempt to resemble an LPS1048 Certificate of Conformity and shall follow the format shown in Appendix 3.

3.16 Annual Returns

The Contractor is to provide to LPCB details of the numbers of sprinkler heads and alarm valves it has installed between January 1st to December 31st each year. Annual returns to be made by 31st July of each following year.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 12 of 19

Appendix 1 - List of acceptable installation standards and publications referred to:

A1.1 Installation Standards

For the purpose of this document Installation Standard will mean, as appropriate:

- a. LPC Rules for Automatic Sprinkler Installations, incorporating BS 5306: Part 2: 1990 (and amendments) – Specification for sprinkler systems, with such LPC Technical Bulletins as are in force at the time, or

[Note – LPS 1048 Certificates of Conformity may be issued for contracts designed to BS 5306: Part 2: 1990 incorporating TB's 1, 2 and 20, for Life Safety systems, providing no other technical bulletins are used to carry out the design. All other contracts shall be certificated against the LPC Sprinkler Rules.]

- b. DD251 Residential and Domestic Sprinklers, or
- c. NFPA 13 (excluding 13D and 13R), or
- d. FM Global Property Loss Prevention Data Sheets (excluding Residential Data sheets).

Note: Hybrid and individualised corporate or institutional specifications are not acceptable to LPCB for the purpose of certification.

Please consult LPCB if a contractor wishes to design to another standard or set of installation standards.

A1.2 Publications

- LPC Rules for Automatic Sprinkler Installations (incorporating BS 5306 Part 2:1990) and all Technical Bulletins
- BS 5306: Part 2: 1990 – Specification for Sprinkler Systems
- DD-251:2000 - Sprinkler systems for residential and domestic occupancies – Code of practice
- ISO 9001:1994 - Model for quality assurance in design, development, production, installation and servicing.
- ISO 9002:1994 - Model for quality assurance in production, installation and servicing.
- ISO 9001:2000 - Quality management systems - Requirements
- BRE Certification – PN 103 – Use of Marks
- BRE Certification – PN 100 – Complaints and Appeals Procedure
- BRE Certification – PN 112 – Notification of change of particulars
- Quality Management Systems Certification Scheme - SD003
- Application form F 015
- GN3/LPS 1048– Guidance Note for the completion of LPS 1048 Certificates of Conformity
- GN4/LPS 1048– Issue of LPS 1048 Certificates of Conformity

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 13 of 19

- GN5/LPS 1048– Supervision requirements
- GN8/LPS 1048 – Transition Arrangements – Notification/Assessment Process (Note – not applicable after 1st January 2007)
- SUP.03 – LPS 1048 Supervision procedure for supervised Contractors
- SUP.F5 – Supervision Agreement (pro forma)
- QP5-3 – Non-conformities and observations

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 14 of 19

Appendix 2 – Surveillance Audits

(a) LPCB Technical Surveillance Audits

Contractors will be audited regularly for continued compliance with the requirements of this scheme document, the installation standards and their general standards of design, installation, testing, commissioning and servicing. The frequency and duration of the audits are dependent on the level in the scheme and whether supervision is provided by a Supervising Body or by the LPCB Supervision Service. A new Contractor entering the scheme at any level, or a contractor moving up a level, will be subject to quarterly surveillance audits for a minimum period of one year and/or until their performance is deemed as satisfactory by LPCB. After this period, the frequency of visits will be as set out in Table 2.

Each surveillance audit will address 2 distinct areas:

1. Compliance with the relevant individual clauses of LPS 1048

All relevant clauses of the standard, identified on the planning matrix, will be audited over an 18 month continuous rolling programme.

2. Compliance with technical standard (and specification) applicable to individual contracts

Level 1 to 3 Contractors:

The firm shall arrange for the LPCB to inspect not less than one completed sprinkler contract, selected by the LPCB, against the Installation Rules and design and layout drawings, at each surveillance audit.

Level 4 Contractors:

The firm shall arrange for the LPCB to inspect not less than two completed sprinkler contracts, selected by the LPCB, against the Installation Rules and design and layout drawings, at each surveillance audit.

(b) Audit findings

Where an audit has identified non-compliances with the scheme requirements or installation standard, they will be documented by the assessor as non-compliance reports (NCR) or observation reports (Obs). Written evidence is to be provided by the installer, in an agreed time-scale, of completion of the necessary corrective/preventative measures.

(c) Surveillance Audit Frequency - Unsatisfactory Performance

Where the LPCB technical surveillance audit reveals significant non-compliances, additional surveillance visits may be required until the matters of concern have been satisfactorily resolved. See paragraph (d) below for Non-Compliances policy.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 15 of 19

Some examples of the areas that may cause an increase in the frequency of audits would be: -

- Design standards falling below acceptable levels
- Breaches of management systems and ISO procedures
- Poor execution of site work resulting in complaints to LPCB

When written complaints with supporting evidence are received by LPCB concerning the execution of any installation contract within the LPS1048 scheme, and there is a prima facie case, then they will be investigated. Such complaints will be drawn to the attention of the listed installing Contractor and where involved the Supervising Body. Contractors will be liable for reasonable costs incurred by LPCB investigating complaints, if found to be at fault.

(d) Non-Compliances Policy

Approval of Contractors is conditional on their satisfactory initial assessment and continued technical audits by LPCB according to the requirements of the scheme.

A Contractor who incurs a small number of minor non-compliances at each LPCB visit and completes effective corrective and preventative actions in the required time will continue to be approved under the scheme. If a Contractor fails to comply with the requirements of the scheme by incurring a large number of minor non-compliances and/or major non-compliance(s), one or more of the following actions will be taken by LPCB:

- A special visit will be carried out on the Contractor, normally within 30 days or at an agreed time after the non-compliances were raised, to verify that the necessary corrective actions have been completed. This visit will be at the cost of the Contractor.
- If the necessary corrective actions are not completed within the agreed time, the Contractor's certification will be suspended or withdrawn.

(e) Withdrawal of Approval

If a Contractor breaches any of the scheme conditions, for example:

- works outside its scope of approval, or
- does not submit a contract for supervision in accordance with clause 3.4

its LPS 1048 approval will be withdrawn for a minimum period of 12 months.

A Contractor may appeal against a decision by LPCB to suspend or withdraw approval using the procedure described in PN 100 Complaints and Appeals Procedure. During the appeal period, the approval remains suspended/withdrawn.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 16 of 19

Appendix 3 – System Report

To be inserted here when format agreed by Expert Group C.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 17 of 19

GLOSSARY OF DEFINITIONS USED

Base Build

There are usually two types of base build contract, shopping centres and multi-storey/high-rise buildings. For shopping centres, the base build contract includes the provision of water supplies, trunk mains and main distribution pipes up to and including the zone valves and sprinkler protection to the malls (if covered) and Landlord's areas. For multi-storey/high-rise buildings, the base build contract includes the provision of the water supplies, trunk mains and main distribution pipes up to and including section/zone valves for each floor or floor section and sprinkler protection to landing and amenity areas.

Fully Hydraulically Calculated

A term applied to pipework sized as specified in BS 5306: Part 2: 1990 clause 18.1(a) or an installation in which all the pipework downstream of the main installation control valve set is sized as specified in 18.1(a). [definition taken from BS 5306: Part 2: 1990 clause 2.33] Refer also to BS clause 24.3.

Install

Install as referred to in this scheme document will be deemed to include the following responsibilities and activities, carried out by the Contractor in respect of each sprinkler contract.

- a. The in house day-to-day management and progressing of the contract including design, procurement, site erection, commissioning and hand-over, including co-ordination with the client, and authorities having jurisdiction and other contractors where applicable.
- b. Purchasing of equipment, materials and labour, and inspection and storage of equipment and materials.
- c. Control by the Contractor of on-site erection teams, whether directly employed or sub-contracted by the Contractor, and the progressive regular inspection of work, final inspection and testing, commissioning, service and maintenance.

Installation Standards

See Appendix 1.

Life Safety

A term applied to sprinkler systems forming an integral part of measures required for the protection of life. [definition taken from BS 5306: Part 2: 1990 clause 2.45]

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 18 of 19

Non-compliance

(a) Listed on LPS 1048 Certificates of Conformity

A departure from the installation standard listed on the LPS 1048 Certificate of Conformity as a non-compliance. The definitions of minor and major are as follows:

Minor - A departure from the installation standard that will not reduce the effectiveness of the sprinkler protection to control or extinguish a fire.

Major - A departure from the installation standard that will significantly reduce the effectiveness of the sprinkler protection to control or extinguish a fire.

Note – a number of minor non-compliances may when taken together constitute a major non-compliance.

If the Contractor is unsure if a non-compliance is either minor or major, they should consult with LPCB before a commitment is made to issue a Certificate of Conformity.

(b) Raised during audits

Non-compliance (sometimes referred to as non-conformity) is used to cover instances where, either during assessment or surveillance audits, the Contractor has not complied with the scheme requirements or the installation standard. Definitions for minor and major non-compliance are described in QP5-3.

Pre-calculated

A term applied to pipework sized as specified in BS 5306: Part 2: 1990 clause 18.1(b) or an installation in which pipes downstream of the design point are sized as specified in 18.1(b). [definition taken from BS 5306: Part 2: 1990 clause 2.53] Refer also to BS clause 24.2.

Sprinkler Contract

For the purposes of this document, Sprinkler Contract means a contract undertaken by a Contractor to design, procure, fabricate, install and commission an alteration or extension to an existing sprinkler system or a new sprinkler installation or system, and completed to the requirements of the Installation Standard.

Sprinkler Installation

Part of a sprinkler system comprising a set of installation control valves, the associated downstream pipes and sprinklers.

BRE Certification and LPCB Scheme Document	SD 1048-1
	Issue 4 September 2003
LPS 1048-1 – Requirements for the approval of Sprinkler System Contractors in the UK and Eire	Page 19 of 19

Sprinkler System

The entire means of providing sprinkler protection in the premises comprising one or more sprinkler installations, the pipework to the installations, and the water supply/supplies (except town mains external to the legal boundary of the premises, inland water courses such as lakes or canals and private reservoirs).

Sprinkler System Alteration

Modifications to an existing sprinkler system or installation.

Sprinkler Systems Contractor

A Company established and registered in the UK or Eire whose principal business, or that of a properly established division of the company, is the design, installation and servicing of sprinkler systems.

Sprinkler System Extension

A sprinkler system extension comprises additional sprinkler protection connected to an existing sprinkler system or installation.

Technical Staff

Personnel employed by the Contractor or by the Supervising Body who have the appropriate qualifications and experience for one or more of the functions of design, installation, commissioning, inspection and maintenance.