EUROPEAN FIRE SPRINKLER NETWORK

**A European Fire Safety Coalition**

# Review of National Quality Assurance Schemes for Fire Sprinkler Systems in European Countries

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## Executive Summary

The European market for fire sprinkler systems has more than doubled since the EFSN began operating in 2003. This has come about as building codes have evolved to recognise the benefits to fire safety of sprinkler systems. These fire safety building code changes are based on the outstanding performance record of sprinkler systems over more than 150 years. To achieve the improvements in fire safety intended by the new codes it is essential that the performance of sprinkler systems is maintained and improved where possible.

This report reviews the quality assurance schemes for sprinkler systems in operation in fourteen European countries. It shows that most have reasonable schemes in place and that where systems are installed for insurance reasons they are inspected, often by an insurer. There remain significant areas for improvement. Ireland, Italy, Spain and the UK do not control the quality of sprinkler systems installed to comply with building regulations. Since these systems are installed for life safety rather than property protection this is a serious weakness. In Italy, Norway and Poland insurers do not require the installer to be third party accredited, there being no such scheme. While nine countries allow anybody to install sprinkler systems for compliance with building regulations, in practice in Germany, Ireland and the UK most systems are fitted by accredited installing companies who can show competence and provide third party certificates of compliance with sprinkler standards.

The Netherlands and Switzerland have the most rigorous systems of quality control in Europe. For every system each step is subject to third party review and all systems must be periodically inspected. In The Netherlands if the system is not installed by a third-party accredited installer the inspections are much more rigorous and expensive. France, Germany and Sweden are close behind but not every design is reviewed by a third party. Due to a shortage of inspectors, the UK allows large installers to perform most of their own inspections of designs and installations, only performing true third-party inspections for a sample of systems.

To improve quality this report recommends that:

- All designs are reviewed by a competent person
- All installers are accredited by a third party
- Every system is inspected by a competent person
- Every system is maintained in accordance with the future EN 12845-1
- Every system is inspected at least once a year by a competent person

Furthermore, if the above competent persons are employed by the installing company, a sample of systems should also be inspected by a third party.

At the time of writing the 2015 edition of EN 12845 is current. It does not go into sufficient detail regarding maintenance measures. This standard is being revised, with a first draft having passed the CEN enquiry and a second draft expected to be circulated for a CEN enquiry late this year and published in 2027. It includes much more detailed maintenance requirements. Meanwhile NFPA 25 is a useful alternative, while some countries also have national guidance documents.

For those countries which do not have a national installer accreditation scheme it would be helpful at a European level, under EN 16763, to define the minimum criteria for an installing company and the skills its key employees should have.

## Background

Fire sprinkler systems have been installed around the world for over 150 years and have built up an outstanding success record in controlling and extinguishing fires. Statistics from many countries and organisations typically report a 97% or 98% success rate. However, the range is from 88% to 99.5%. Although at first glance the difference between 88% and 99.5% success may not seem significant, the ratio of the corresponding failure rates is 24.

Part of the difference is due to the skewing of data. For example insurance statistics tend only to include those fires that caused a loss above the excess on the policy: they leave out the many occasions when damage was so slight that an insurance claim was not made. Likewise, fire brigade statistics do not include fires extinguished by the sprinkler system so quickly that the fire brigade was not called. However, the general quality of the installed systems also has an impact, if unquantified, on performance.

The factors that contribute to the success of sprinkler systems are:

- the existence of appropriate design standards
- their application by qualified, trained personnel
- the use of appropriate components
- installation by competent, adequately supervised staff
- inspection and commissioning of the new system by a competent person
- regular system service and maintenance by trained staff
- periodic inspections of the system by a competent person

Quality does not come without a cost so companies can only offer the above services and win business if they form part of a quality control scheme that is strictly enforced, ideally through third party assessment of individuals and companies. The outstanding success of sprinkler systems depends on such schemes. Where a quality assurance scheme is not in place we can expect the long-term performance of sprinkler systems to be inferior to elsewhere.

The European Fire Sprinkler Network encourages the wide-spread installation of competently installed and maintained fire sprinkler systems to improve Europe's fire safety. Since the EFSN began operating in 2003 the European sprinkler market has more than doubled. As we increase the application of fire sprinkler systems in Europe it is essential that we do not allow quality to slip but take the opportunity to learn best practice from each other so as to raise quality.

To assist policy makers in the development of building codes and related legislation, and others interested in best practice in quality assurance, the EFSN has made an overview of the current quality assurance schemes in operation in various European countries. This overview has been split into two parts: the insurance market, where systems are installed because of the influence of insurers; and the code market, where systems are installed because the authorities or the building code require them. The data are presented in Tables 1 and 2.

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# Table 1 Insurance Market

| | Belgium | Denmark | Finland | France | Germany | Ireland | Italy | Netherlands | Norway | Poland | Spain | Sweden | Switzerland | U.K. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Design** | | | | | | | | | | | | | | |
| Which is the usual design standard? | NFPA 13 | DBI 251 | CEA 4001 EN12845 | R1 | VdS CEA 4001 | FM | NFPA 13 EN 12845 | NFPA 13 FM | EN 12845 | EN 12845 VdS 4001 | EN 12845 | SBF 120:8 | VKF 19-15 + SES Standard | EN 12845 +LPC Rules |
| Which other design standards are accepted by insurers? | FM | EN 12845 NFPA 13 FM | NFPA 13 FM | NFPA 13 FM | NFPA 13 FM | LPCB NFPA 13 | FM | VdS, EN 12845+ NEN 1073 | NFPA 13 FM, VdS | NFPA 13 | FM NFPA 13 | EN 12845 NFPA 13 FM CEA 4001 VdS | FM VdS CEA 4001 NFPA 13 SN EN 12845 | NFPA 13 FM |
| Do insurers require project designs and drawings to be reviewed? (NO/YES/SOMETIMES) | YES | Only FM | SOME-TIMES | NO | SOMETIMES | YES | YES | YES | YES | SOME-TIMES | SOMETIMES | SOME-TIMES | YES | YES |
| Who carries out this review? | ANPI or FM | FM | Insurer | Installer | VdS | Insurer LPCB | Insurer | Installer, inspection and/or certification body | Approved Inspectors | Approved Inspectors or VdS | Insurer/ CEPREVEN | Certified sprinkler engineers | Cantonal building insurance or certified bodies | Insurer, installer |
| For what % of projects is this review performed (<20; 20-40; 40-60; 60-80; >80)? | >80 (100) | <20 Only FM | 20-40 | >80 (100) | 20-40 | >80 | <20 | >80 (100) | >80 | | 40-60 | 50-60 | >80 (100) | >80 |
| | | | | | | | | | | | | | | |
| **Installers** | | | | | | | | | | | | | | |
| Do insurers usually require sprinkler system installers to be certificated by a third party? | YES | YES | YES | YES | YES | YES | NO | YES | NO | NO | SOMETIMES | YES | YES | YES |
| Who carries out the certification? | ANPI | DBI | TUKES | CNPP | VdS | LPCB | Not available | Certification bodies | | | CEPREVEN | SBSC | VKF | LPCB, Part B Cert or IFCC |
| How many certificated installers are there? | 20-25 | 18 | 41 | 21 | 59 | 5 | Not available | 21 | | | 53 | 28 + 1 residential + 2 water mist | 27 | 113 |
| For what % of projects do insurers require a certificated installer? (<20; 20-40; 40-60; 60-80; >80) | >80 (100) | >80 (100) | >80 (100) | >80 (100) | >80 | 60-80 | - | >80 (100) | | | 40-60 | >80 (100) | >80 (100) | >80 |
| | | | | | | | | | | | | | | |
| **Inspection** | | | | | | | | | | | | | | |
| Do insurers usually require an inspection of newly completed sprinkler systems? | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | SOMETIMES | YES | YES | YES |
| Who carries out these inspections? | ANPI | DBI & RM | Inspection bodies | CNPP | VdS | Insurer LPCB FM | Insurer | Installer, inspection or certification body | Approved inspector | Approved Inspectors or VdS | Insurer/ CEPREVEN | SBSC certified companies | Cantonal building insurance or its commissioned expert | Insurer, installer or LPCB, Part B Cert or IFCC |
| For what % of projects is this inspection performed? (<20; 20-40; 40-60; 60-80; >80) | >80 (100) | >80 (100) | >80 | 60-80 | 60-80 | >80 | 40-60 | >80 (100) | >80 | >80 | <20 | >80 | >80 | >80 |
| Do insurers require periodic inspections of existing sprinkler systems? | YES | YES | YES | YES | YES | YES | NO | YES | YES | YES | NO | YES | YES | YES |
| How often? | 6 months | 1 year | 1-3 years | 6 months | 1-2 year | 1 year | | 6-12 months | 1 year | 1 year | | 1 year | 1-5 years | 3 months |

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# Table 2 Code Market (Where Sprinklers are Required by Law or the Fire Brigade)

| | Belgium | Denmark | Finland | France | Germany | Ireland | Italy | Netherlands | Norway | Poland | Spain | Sweden | Switzerland | U.K. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Design** | | | | | | | | | | | | | | |
| What is the usual design standard? | EN 12845 | DBI 251 | CEA 4001 EN 12845 | EN 12845 | DIN EN 12845 | EN 12845 BS 9251 | NFPA EN 12845 | EN 12845+ NEN1073 NFPA FM | EN 12845 EN 16925 | EN 12845 VdS 4001 | EN 12845 | EN 12845 SBF 120:8 EN 16925 | VKF 19-15 + SES Standard | EN 12845 or BS 9251 |
| What other design standards are accepted by government? | NFPA 13 FM | EN 12845 | NFPA 13 FM | R1 NFPA 13 | VdS CEA 4001 FM NFPA | NFPA FM | FM | VdS | NFPA 13 FM | NFPA 13 FM | NFPA 13 FM | NFPA 13 FM | FM VdS CEA 4001 NFPA 13 SN EN 12845 | NFPA FM |
| Does the government require project designs and drawings to be reviewed? (NO/YES/SOMETIMES) | YES | NO | SOME-TIMES | Yes for public buildings | SOMETIMES | YES | NO | YES | YES | NO | SOME-TIMES | SOME-TIMES | YES | SOMETIMES |
| Who carries out these reviews? | ANPI or Vinçotte | | Inspection bodies | Veritas /Socotec /Apave /DEKRA | Accredited experts | Fire Officer | | Installer, inspection and/or certification body | Approved inspector | | Inspection bodies | Certified sprinkler engineers | Cantonal building insurance or certified bodies | LPCB, Part B Cert or IFCC |
| For what % of projects is this review performed (<20; 20-40; 40-60; 60-80; >80)? | >80 | | 20-40 | >80 | 20-40 | <20 | | >80 (100) | >80 | | 20-40 | 50-60 | >80 (100) | 2 projects/year per installer |
| | | | | | | | | | | | | | | |
| **Installers** | | | | | | | | | | | | | | |
| Does the government usually require sprinkler system installers to be certificated by a third party? | YES | YES | YES | NO | NO | NO | NO | NO | NO | NO | NO | YES | YES | NO |
| Who carries out the certification? | ANPI | DBI | TUKES | CNPP | | | | Certification body | | | | SBSC | VKF | LPCB, Part B Cert or IFCC |
| For what % of projects does the government require a certificated installer? (<20; 20-40; 40-60; 60-80; >80) | >80 | >80 (100) | >80 | >80 (required by market) | | | | >80 (100) | | | | >80 (100) | >80 (100) | 2 projects/year per installer |
| | | | | | | | | | | | | | | |
| **Inspection** | | | | | | | | | | | | | | |
| Does the government usually require an inspection of newly completed sprinkler systems? | YES | YES | YES | YES | YES | NO | NO | YES | YES | YES | NO | YES | YES | NO |
| Who carries out these inspections? | ANPI or Vinçotte | DBI | Inspection bodies | Veritas /Socotec /Apave /DEKRA | Accredited experts | | | Inspection body | Approved inspector | Approved inspector | Inspection bodies | SBSC certified companies | Cantonal building insurance or commissioned expert | Installer, LPC or FIRAS |
| For what % of projects is this inspection performed? (<20; 20-40; 40-60; 60-80; >80) | >80 | >80 (100) | >80 | >80 | >80 (100) | | | >80 (100) | >80 (100) | >80 (100) | 20-40 | >80 | >80 | 2 projects/year per installer |
| Does the government require periodic inspection of existing sprinkler systems? | YES | YES | YES | YES | YES | NO | | YES | YES | YES | YES | YES | YES | NO |
| How often? | 6 months | 1 year | 3 years | 6 months | 3 years | | | 1 year | 12 months | | 5 years | 1 year | 1-5 years | 12 months |

## Insurance Market

Fire sprinkler systems are often installed in Europe either to obtain an insurance discount or because insurance cover is otherwise hard to find. Respondents to this survey either claimed that the insurance-driven market is static or that it is declining. In Spain it was claimed no longer to exist. Fortunately, across Europe many of the buildings that in the past were protected with sprinklers only at the request of insurers are now protected to comply with building codes.

*Design*
In most countries insurers no longer use the European insurers' standard CEA 4001 but now use EN 12845, often with local additional requirements. Insurers in all countries allow the use of the internationally-recognised NFPA or FM design standards. Some will also accept LPC or VdS, although these are not often proposed outside the UK & Ireland and Germany respectively. All these standards are based upon many years of experience, which have shown that if a system is designed in accordance with the standard and maintained ready to function, it will control or extinguish fire in all but the most exceptional circumstances.

In most countries insurers require a review of system designs. This can pick up errors made either through ignorance or to cut costs. If insurers do not require a review of designs or conduct it themselves, their requirement for installer third party accreditation includes a review of a sample of the designs by those installers.

*Installation*
Inspection of finished systems will uncover most errors made during installation but not all errors, since some will be hidden. Most insurance associations recognise this and so in addition to inspections of finished systems they supervise the competence of installers through an accreditation scheme. In the U.K. many system inspections are performed by the installer under a supervised scheme, so that only a sample of sites is actually inspected by an independent party. This reduces the cost of the scheme and accommodates the reality of an insufficient number of inspectors.

*Periodic Inspection*
Insurers in Italy do not require periodic inspections, although they are in favour of them. Over time the system could become non-operational or the hazard may change so that the sprinkler system can no longer protect it. The European standard, EN 12845, requires quarterly reviews of the hazard and extensive inspections. Only UK insurers enforce reviews with this frequency although in Belgium, France, Germany and The Netherlands systems are typically inspected every six months. Systems in the UK are not usually inspected by third parties and fire brigade data suggests reliability of 94-95%, lower than in countries with third party inspection regimes. CEN does not allow a standard to specify who should assess conformity so instead EN 12845 calls for a qualified person to perform the inspection, referring to an informative annex to suggest what would make someone qualified. That annex includes a recommendation that the inspection be conducted by an independent body.

## Code Market

Today many more fire sprinkler systems are installed because they are required by building codes and this part of the market is growing as legislators recognise the role that sprinklers can play in improving fire safety.

*Design*
In most countries EN 12845 is the usual design standard, although national insurance standards, NFPA standards or FM data sheets are also accepted in many countries. Residential sprinklers are now being installed in Belgium, France, Netherlands and the Nordic countries in accordance with EN 16925 and in the UK and Ireland in accordance with BS 9251. In five countries the authorities require a review of designs and they sometimes require it in four others.

*Installation*
In half the countries the authorities require that sprinkler contractors be accredited by a third party and in 11 of the 14 countries installed systems must undergo an inspection. In countries without widely applied installer accreditation schemes the code market is served by different companies than the voluntary or insurance market. The quality of the systems installed in the code market is then suspect.

*Periodic Inspection*
In 11 of the 14 countries the authorities require periodic inspection of all sprinkler systems. The frequency of these inspections varies around Europe from every six months to every five years, sometimes varying within a country depending on the protected occupancy. In France the regulations require an inspection every three years (and list what should be inspected) but end users require more frequent inspections to cover their potential liability. Without periodic inspection and the enforcement of necessary remedial action, systems may become inoperable or the hazard may change so that the sprinkler system is no longer designed to protect it. These are the most common causes of sprinkler system failure. In some countries these inspections are conducted by the installer, while in others they are done by a third party.

## Components

There are European and international product standards for key sprinkler system components. Those for a basic range of fire sprinklers, alarm valve assemblies, water turbine alarms and flow switches are harmonised, meaning that they have been referenced in the Official Journal of the European Union. Components covered by these standards must be tested against them and CE-marked. Further standards exist for other sprinklers, sprinkler pumps and pump sets. These are voluntary and cannot be used to confer the CE mark. EN 12845 is currently being amended to refer to them, so that any contract that requires compliance with EN 12845 will also require compliance with these standards.

Installers of sprinkler systems all use products that have been independently tested and approved against these standards and insurance test protocols by third party laboratories. There are relatively few suppliers and the quality of their supply is tightly controlled. This is the most rigorously and consistently enforced part of the

quality assurance system. Counterfeit and unapproved products are not installed in the countries covered by this survey. Unfortunately, such sub-standard products are installed in Turkey.

Other components such as pipe, fittings and pipe supports are supplied to comply with national or international standards. Installers have little incentive to use sub-standard supply of these products and quality issues are rare.

## Installer Accreditation Schemes

Most countries have at least one national installer accreditation scheme. The UK has three for industrial and commercial installers, and three for residential installers. The Netherlands has one for industrial and commercial installers and another for residential installers. The Netherlands requires that installers be accredited under these national schemes, which are approved by a government-funded body. In France the authorities do not directly require the installer to be accredited but to cover potential liability and show all reasonable steps to ensure system effectiveness were taken, end users and consultants specify that an accredited installer should install the system.

The different schemes address many of the same aspects of quality control. Some important differences are whether the installer performs the design and whether the sprinkler fitters may be sub-contractors. In the past all the accreditation schemes only applied to a company. Thus an individual could pass a test of competency to design sprinkler systems but did not obtain a personal qualification. Instead, the company then met one of the accreditation criteria. The same applied to site supervisors. This is now changing, with personal qualifications available and required under some accreditation schemes, such as in the UK. Some of those schemes also comply with EN 16763 *Services for fire safety and security systems*, published in 2016, which introduced guidance for qualifications for key people.

## Recommendations

1) Countries seeking to reduce the risk of sprinkler system failure even further should adopt a comprehensive system of quality assurance. The essential elements are:

- All designs are reviewed by a competent person
- All installers are accredited by a third party
- Every system is inspected and commissioned by a competent person
- Every system is serviced and maintained in accordance with EN 12845 or insurance guidelines
- Every system is inspected at least once a year by a competent person

2) Ideally the above competent person should in each case be a third party. If the competent person is employed by the installing company (first party), a sample of systems should also be inspected by a third party.

3) Since EN 12845 and other design standards cannot specify what skills or experience sprinkler installers should have, the sprinkler industry, insurers and other interested parties should produce a common set of criteria. Where this does not

already exist, third party accreditation schemes supported by insurers in other countries can serve as examples. EN 16763 can also provide a framework.

# The European Fire Sprinkler Network

Since 2003 the European Fire Sprinkler Network www.eurosprinkler.org has been open to membership of all those with an interest in improving fire safety through encouraging the fitting of fire sprinkler systems. Its members include fire protection associations from several countries; fire brigades; leading insurance companies; sprinkler manufacturers, installers and their associations; the main laboratories in Europe which certify fire protection products and systems; and consulting companies.

The current membership includes organisations and companies from 17 European countries and represents thousands of fire safety professionals across Europe.