Fire protection engineers use science and technology to protect people and property from fire. When designing new buildings or renovations to existing buildings, fire protection engineers develop the plan for fire protection.
Fire protection engineering has evolved significantly over the past several centuries. Early application of fire protection engineering was intended to prevent conflagrations, which could destroy entire cities. Until the early 1900s, the primary objective of fire protection engineering was to limit a fire to its building of origin. As fire protection engineering advanced, this objective was refined to limit a fire to its object or room of origin.

However, it wasn't until the later part of the 20th century that fire protection engineering had matured to the point that it included the fundamental tenets of a distinct, professional discipline (Licht, 1989).

Description

A. Professional Definition
Fire protection engineering is the application of science and engineering principles to protect people and their environment from destructive fire, which includes:

- analysis of fire hazards
- mitigation of fire damage by proper design, construction, arrangement, and use of buildings
- materials, structures, industrial processes, and transportation systems
- the design, installation and maintenance of fire detection and suppression and communication systems, and
- Post/fire investigation and analysis.

A fire protection engineer by education, training, and experience:

- is familiar with the nature and characteristics of fire and the associated products of combustion
- understands how fires originate, spread within and outside of buildings/structures, and can be detected, controlled, and/or extinguished, and
- is able to anticipate the behaviour of materials, structures, machines, apparatus, and processes as related to the protection of life and property from fire.

B. Professional Role in 'Whole Building' Design

Fire protection engineers exemplify the concept of "whole building design." Fire protection engineers design systems that, taken individually, could be considered mechanical (fire sprinklers, fire-fighter's standpipes, smoke control), electrical (fire alarm), architectural (means of egress design), or structural (fire resistance design).

When designed by fire protection engineers, these systems are coordinated into a comprehensive, fire and life safety strategy.
It is beneficial to involve fire protection engineers in a design at the earliest stages of planning, generally at the feasibility or concept design stage. The benefits of involving a fire protection engineer at this stage include:

- Greater design flexibility
- Innovation in design, construction, and materials
- Equal or better fire safety
- Maximization of cost/benefit

Conversely, if a fire protection engineer is not brought in to a project team until after problems are identified, delays can result as the fire protection engineer analyses the problem and develops solutions. At this stage there may be reduced design flexibility available and resistance to change by team members from other disciplines, if portions of the project design have been completed and decisions approved. This is particularly true in cases where fire protection problems are not identified until plans are submitted for regulatory approval.

Additionally, fire protection engineers can ensure that security related provisions designed into a building do not diminish fire safety to occupants. For example, ensure that access control to a building does not also make it more difficult to quickly exit a building in the event of a fire or similar emergency.

C. Strategies for Achieving "Whole Building" Design Objectives

For most projects, fire protection engineering is largely practiced through the application of prescriptive codes and standards. For broad classifications of occupancies or fire hazards, prescriptive codes and standards identify, in very specific terms, exactly how individual fire protection systems are to be designed, installed, tested, and maintained.

Prescriptive codes and standards have the benefit that they are easy to apply and enforce. Additionally, buildings designed to prescriptive codes and standards have a good history of performance in fires. However, they do not result in uniform levels of safety or cost-benefit. Consider, for example, stores classified as mercantile occupancies. A store that sells greeting cards would fall under this occupancy classification, as would a store that sold liquor in bottles. Although the protection that would be required in these stores would be similar, the fire hazard presented by these stores would be different. It is not a one size fits all approach.

"Performance-based design" is a tool that can be used to look at fire safety from a "whole building" perspective. "Performance-based design" is an engineering approach to fire protection design based on
(1) established fire safety goals and objectives,
(2) analysis of fire scenarios, and
(3) quantitative assessment of design alternatives against the fire safety goals and objectives using engineering tools, methodologies, and performance criteria.

When using performance-based designs, fire safety goals for a building are identified. These goals may include life safety, property protection, mission continuity, and environmental protection. These goals are subsequently refined into quantitative measures of building performance through engineering analysis and consultation with building stakeholders, such as the building owner and code enforcement officials. Next, fire scenarios are established. Fire scenarios are descriptions of the types of fires from which the building is intended to provide protection.

The next step is the selection of design strategies. The types of fire protection strategies that are used in performance-based design are no different than those that are used when applying prescriptive codes, such as detection, suppression, egress, or fire endurance.

After fire protection strategies are developed, they are evaluated using engineering tools and models to determine whether the fire safety goals are met for each of the fire scenarios.

For most buildings, the entire building will not be designed on a performance basis. Much of the building will be designed using prescriptive codes, and for relatively simple buildings, all of the building will likely be designed using prescriptive codes. However, performance-based design offers opportunities to achieve desired aesthetics or functionality in a building. It also ensures that the fire performance of the whole building will be considered as more than an agglomeration of single systems.

Historically, performance-based design has been practiced by use of "equivalency" or "alternate methods and materials" clauses found in most prescriptive codes. These clauses permit the use of strategies other than those specified in the code, provided that they provide an equivalent or greater level of safety. Within the last few years, performance-based codes and design guides have been published.

Designing from a "whole building" approach does not require that design be on a performance-basis. It is necessary, however, that the design of fire protection-related systems be coordinated with each other and with other building systems and the overall building design.

D. Relationship to Building Systems and Relevant Codes and Standards

Fire protection engineers generally design the following types of systems:

- Fire sprinklers
- Standpipes
- Fire detection and alarm
- Special hazards systems, such as clean agents, water mist, or CO^2
- Smoke management

Additionally, fire protection engineers frequently collaborate with other design professionals in the design of the following systems:

- Structural fire resistance
- Fire rated construction
- Means of egress

E. Interaction with Other Disciplines

Designing a building from a 'whole building' approach requires a fire protection engineer to coordinate the different types of fire protection that are designed into buildings including:
coordination of sprinkler system zoning with fire alarm system zoning
coordination of sprinkler system water flow and tamper switches with the fire alarm system
coordination of fire alarm and egress system with building security
coordination of smoke control systems with detection and HVAC system designs
coordination of fire separations with architectural designs
coordination of penetrations of fire rated assemblies with mechanical and electrical designs (e.g., piping, ductwork, and wiring penetrations)
coordination of means of egress with architectural designs.

Emerging Issues

Performance-based design has been practiced for decades through the use of "equivalency" clauses and "alternate methods and materials" clauses found in most prescriptive codes. In these cases, performance-based design was applied on an ad-hoc basis, with the approach used developed between the designer and code enforcement official.

Over the last decade, performance-based design has become more formalized. In the U.S., several performance-based codes have been published, including the International Performance Code and performance-based options within the NFPA Building Construction and Safety Code and the NFPA Life Safety Code and in UK LPC (Loss Prevention Council). Additionally, several guides have been published by the Society of Fire Protection Engineers that provide information intended to facilitate performance-based design, including the SFPE Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings.

Performance-based design facilitates designing fire protection from a "whole building" perspective, as it requires that interactions between all fire protection systems with the building and its occupants be considered.

Additionally, in the wake of 9/11, several issues, such as structural fire protection and means of egress of high-rise buildings, are receiving increased attention. This attention may result in changes in the way buildings are designed, or an affirmation of current approaches.

When installing any fire safety items or equipment in a premises it is very important that it meets the highest quality standard and is installed correctly. Also when it is called upon, in a fire situation, it will achieve its function and will operate as expected.

This is achieved by ensuring the equipment and the installation meets the standards as laid down in the appropriate British Standard Specification. Also when negotiating a contract with the installer ensure he fully understands your requirements, those of the BS standard and it is clear that it is their responsibility to provide a commissioning certificate when the fire safety system has been installed.

What is a Standard?

A standard is defined as a document, established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results. But a standard is so much more they are varied and can exist for things (e.g. fire alarms) and, increasingly, for making things happen (e.g. services) but mainly standards represent an indispensable level of know-how in any given area. In the context of public contracts or international trade, standards are essential to simplify and clarify contractual relations.

Any standard is a collective work. Committees of manufacturers, users, research organizations, government departments and consumers work together to draw up standards that evolve to meet the demands of society and technology.

Who needs standards and why are they important?

By law, many industry bodies and trade associations require products (e.g. fire alarm detector heads) to conform to a British standard or a European directive before they can be offered for sale in the UK or EU; this ensures members compete on equal terms.

The use of standards is becoming more and more of a prerequisite to worldwide trade. A very large percentage of export is influenced by the European and international standards business. For instance all European Union standards are automatically adopted as British Standards.

Above all, any business, large or small, can benefit from the conformity and integrity that standards will bring. Management standards, in particular, can be of benefit to any organization. Standards are essential to trade in increasingly competitive markets. They ensure any business offering products, services or processes is, cost-effective and time efficient, commercially viable, credible and safe.

The trend is towards international standardization, particularly through ISO (International Organization for Standardization). Exciting new technologies are making it possible to interact instantaneously and trade globally. To maximize exporting potential, standards that reflect a global perspective and common understanding need to be in place and used. Consumers' too, value the reassurance of safety and quality that conformity to a standard brings. Standards enable the creation of a safer, healthier workplace, in the case of environmental management, facilitate progressive steps towards eliminating the harmful effects of industry on the environment.

Specific benefits to business include:

- Customer satisfaction
- Cost and time effectiveness
- Legal compliance
- Better management (through management standards)
- Integrity
- Trust
- Ability to build a better brand
- Ease of export/credibility as an international player.
- Every business can benefit from standards – from industry giants to sole-traders seeking to maximize competitive advantage.

The types of standards – British and Worldwide

Both British and International standards cover the entire spectrum of products, services and processes from administration to zip fasteners. BSI's Library has access to over 500,000 different standards). There are also many foreign standards.

- All British standards use the product identifier "BS"
- All British adoptions of European Standards are identified with "BS EN"
- All International standards are identified with "ISO"
- All International standards adopted as British standards are identified with "BS ISO".
- Technical Information Group (TIG) classifies International standards and can advise you on many areas of your business such as product consultancy and labelling.

Why do we have Standards?

What would life be like if, credit cards were different sizes, light bulbs didn't fit into lamps, railway lines were different widths, microwave ovens emitted large amounts of harmful radiation, washed clothes no longer fitted because there were no care labels or warnings. Standards affect our daily lives in many ways, making life easier, safer and healthier. Here are a few examples, ensuring electrical wiring is safe in the equipment we use in homes and offices, rationalising clothes sizes across different countries, assisting businesses to improve the environment with environmental management systems, advising on safety of sunglasses to protect our eyes, guidance on Data Protection to protect us from inaccurate information being held on us by companies and employers, and helping to make buildings more accessible to disabled users.

Standards normally relate to products, while the codes of practice relate more to installations, theoretically, codes of practice are not specifications (even though we all tend to use them as such). Standards on the other hand, relate to products mostly, having a pass/fail criteria for the purpose of third party certification (e.g. kite marking). With standards the word "shall" is used and the word "should" is not because a test lab would not be able to test a product using the pass/fail criteria. Thus, technically, standards contain "requirements", albeit that they may not be legal requirements and it is simply that if you want to claim compliance, you comply with the entire standard. A code of practice is the opposite, it contains only recommendations so there are no requirements, and the words "shall" and "must" cannot be used. Our European cousins are not into codes of practice, but only product standards so the EN is, as you say, a standard that contains requirements. The bottom line is that you can use the new EN now, and adopt its requirements, rather than those of the British standard.

BS 5306 – 2 is the standard used in Zimbabwe that was adopted by FPIB (Fire Prevention Inspection Bureau) department of the ICZ (Insurance Council of Zimbabwe)
BS 5306 – 2: 1990 gives requirements and recommendations for fire sprinkler systems to be installed in buildings and industrial plants. It covers the initial contract arrangements, designing of the system, installation of the system, testing and maintenance of the systems. It gives specific requirements for sprinkler systems which are essential to measures put in place to protect lives and property.
Covered within this document:

- Hazard classification
- Water supply provisions
- Installation & testing of system
- Maintenance of system
- Extension of existing system

While there is nothing mysterious about sprinklers system the high reliability and effectiveness of these systems has come about over years by strict adherence to the sprinkler rules and design standards. It would be wise to select a contractor who is not only capable and competent but who also has an established track record and who can offer proof of compliance with quality assurance system.
For a fire system to operate properly and successfully deal with a fire, it must be correctly designed, installed and maintained. It is therefore essential that the system is designed using a specification that has been tried and tested and proved to provide the level of protection desired and components used themselves also be tested and approved for the use in those systems.
Sprinklers can be installed using any one of accepted international standards.

The most widely used in Zimbabwe is the LPC Rules for Automatic Sprinkler Installations incorporated BS EN 12845, authored and published by the FPA (Fire Protection Association), with input from wide variety of industry experts. Prior to this LPC Rules for Automatic Sprinkler Installations incorporated BS 5306 –2 was commonly used.
In 1990, the British Standards Institution issued BS 5306 – 2: 1990: Fire Extinguishing installations and equipment in building: Specifications for sprinkler system.
Relevant Codes and Standards

Fire protection is impacted by a number of codes and standards. The most frequently used codes and standards include:

Fire Doors

BS 8214:2008	Code of practice for fire door assemblies
BS EN 1634-1:2008	Fire resistance and smoke control tests for door, shutter and, openable window assemblies and elements of building hardware. Fire resistance tests for doors, shutters and openable windows which is an alternative for BS 476 – 22: 1987

Portable Fire Extinguishers

BS EN 3-10:2009	Provisions for the attestation of conformity of portable fire extinguishers in accordance with EN 3 Part 1 to Part 5. Amendment 1
BS EN 3-7 2004 + A1: 2007	Characteristics, performance requirements and test methods
BS EN 3-8:2006	Additional requirements to EN 3-7 for the construction, resistance to pressure and mechanical tests for extinguishers with a maximum allowable pressure equal to or lower than 30 bar
BS 7863:2009	Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers

Fire extinguishing installations and equipment on premises.

BS 5306-0:1986	Guide for the selection of installed systems and other fire equipment
BS 5306-1:2006	Hose reels and foam inlets
BS 5306-2:1990	Specification for sprinkler systems
BS 5306-3:2009	Commissioning and maintenance of portable fire extinguishers.
BS5306-4:2001	Specification for carbon dioxide systems
BS 5306-5.1:1992	Halon systems. Specification for halon 1301 total flooding systems
BS 5306-5.2:1984	Halon systems. Halon 1211 total flooding systems
BS EN 13565-2:2009	Fixed firefighting systems. Foam systems. Design, construction and maintenance
BS 5306-8:2000	Code of practice for Selection and installation of portable fire extinguishers.

Emergency Lighting

BS 5266-1- 2011	Gives general rules and guidance on the provision and operation of emergency lighting in most premises other than dwellings
BS EN 1838:1999/BS 5266-7:1999	Specifies the illumination to be provided by emergency lighting (including luminance, duration and colour)
BS EN 50172:2004/ BS 5266-8:2004	Specifies the minimum provision and testing of emergency lighting for different premises
BS EN 60598-1: 2008	Luminaire's. General requirements and tests. Check out the 60598 series for particular requirements.
BS EN 62034:2006	Automatic test systems for battery powered emergency escape lighting .Specifies a test system for battery powered emergency lighting
BS EN 50171:2001	Specifies central power supply systems for luminaire for emergency lighting

Fire detection and fire alarm systems

BS 5839-1:2002+A2:2008	Fire detection and fire alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance
BS EN 54-11:2001	Fire detection and fire alarm systems. Specification for manual call points has replaced BS 5839-2:1983
BS 5839-3:1988	Specification for automatic release mechanisms for certain fire protection equipment.
BS EN 54-4:1998	Fire detection and fire alarm systems. Power supply equipment has replaced BS 5839-4:1988
S EN 54-2:1997+A1:2006	Fire detection and fire alarm systems. Control and indicating equipment has replaced BS 5839-4:1988
BS 5839-6:2004	Fire detection and fire alarm systems for buildings. Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings
BS 5839-8:2008	Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of voice alarm systems
BS 5839-9:2003	Fire detection and alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems

Guides to BS 5839

BIP 2109:2008	The Design, Installation, Commissioning and Maintenance of Fire Detection and Fire Alarm Systems: A Guide to BS 5839-1 (3rd edition)
BIP 2044:2004	A Guide to BS 5839-6:2004
BIP 2124:2009	The Design and Installation of Voice Alarm Systems. A Guide to BS 5839-8

Associated British Standards

BS 5446-2:2003	Fire detection and fire alarm devices for dwellings. Specification for heat alarms
BS 5446-3:2005	Fire detection and fire alarm devices for dwellings. Specification for smoke alarm kits for deaf and hard of hearing people
BS 5979:2007	Remote centre's receiving signals from fire and security systems. Code of practice

AMERICAN STANDARDS

•National Fire Protection Association (NFPA)

- NFPA 13, Standard for the Installation of Sprinkler Systems
- NFPA 72, National Fire Alarm Code
- NFPA 101, Life Safety Code
- NFPA 1, Uniform Fire Code
- NFPA also publishes several codes and standards which cover specific aspects of fire protection and fire related hazards.
- International Code Council
- International Building Code
- International Fire Code

ASTM publishes several fire protection related standards through its E-5 committee.