Contents

1. Introduction

In many commercial and industrial locations fire extinguishing and fire suppression systems are installed to either detect and extinguish a fire (fire extinguishing system) or detect and hold the fire in check so that other available means of fire extinction can take place (fire suppression system).

Fire extinguishing and fire suppression systems generally comprise one of the following:

- A sprinkler system
- A foam system
- A gaseous flooding system.

This topic considers the relevant requirements of *BS 7671* and those of particular specifications and codes of practice for water sprinkler, foam and gaseous flooding systems (specifically carbon dioxide and argon-based systems), with respect to safety services for such systems.

General information on the requirements of *BS 7671* for safety service sources and circuits can be found in Topics ***S13-23*** and ***S13-11***.

The particular requirements for safety sources for water sprinkler systems, foam systems and gaseous flooding systems are dealt with in items 2, 3 and 4 respectively.

2. Water sprinkler systems

The introduction to *BS EN 12845: 2004 Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance* explains that a water sprinkler system consists of a water supply or supplies and one or more sprinkler installations. Clause 9 of the standard states that the water supply may come from town mains, storage tanks, an inexhaustible supply, such as a river, canal or lake, or from pressure tanks.

Clause 10.7.5.2 of *BS EN 12845: 2004* states that any pumpset is to start automatically when the pressure falls in the trunk main* and that it is to run continuously until it is manually stopped. Therefore, any safety supply should be selected and installed so as to be capable of complying with this clause.

2.1 Electricity supply

2.1.1 Electrically driven pumpset

Where the water sprinkler system pump is electrically driven it is necessary for an electrical supply to be available to the pumpset† at all times (clause 10.8.1.1 of *BS EN 12845: 2004* refers).

Clause 10.8.2.1 of *BS EN 12845: 2004* recommends that the supply for the sprinkler system pumpset should be taken from the input side of the main incoming switch at the origin of the installation where this is permitted by the electrical distributor. Fig 1 refers.

Electricity supply taken from the input side of the main switch

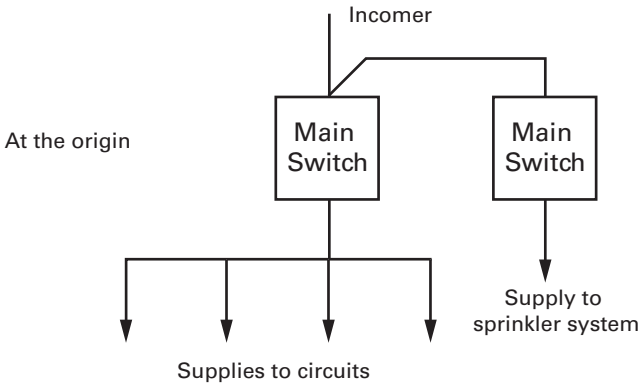

Fig 1

* The trunk main is the pipe connecting two or more water supply pipes to the installation control valve set(s).

† A pumpset combines the starter and the motor required to operate the pump.

-Where a distributor refuses permission the electrical supply should be taken from a point at the origin of the installation, on the load side of the main incoming switch (See Fig 2), clause 10.8.2.1 of *BS EN 12845: 2004* refers.

Example of electricity supply taken from the load side of the main switch for the sprinkler system

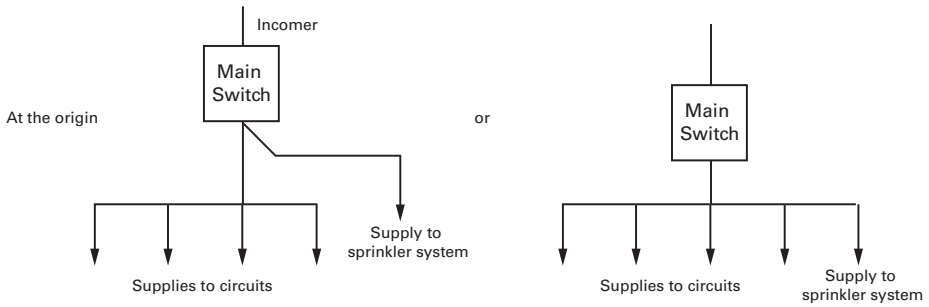

Fig 2

The electrical supply for the sprinkler system pump motor and starter is to be used solely for that purpose and is to be separate from all other connections. The cross-sectional area (csa) of the cable between the main switchboard and the pump controller should be determined by taking 150 % of the largest full load current (clause 10.8.4 of *BS EN 12845: 2004* refers).

Regulation 560.7.2 requires a circuit of a safety service to have adequate fire resistance for the locations through which it passes, and clause 10.8.2.2 of *BS EN 12845: 2004* recommends that all cables are protected against fire and mechanical damage. Ideally, cables should be installed outside the building or through parts of the building where the fire risk is negligible and which are separated from any significant fire risk by walls, partitions and floors having fire resistance of no less than 60 minutes. If this is not practicable then the cables should either be buried or given additional protection. Additionally, all cables should be of a single length containing no joints.

Where there is no standby supply for the normal mains supply to the electrically-driven sprinkler system pumpset, the designer may need to consider the use of a diesel-engine driven pumpset. See item 2.1.2.

2.1.2 Diesel driven pumpset

Where a diesel engine pumpset is used, clause 10.9.7.1 of *BS EN 12845: 2004* requires that both automatic and manual starting systems are provided, each system being independent of the other, with the exception of the starter-motor and the batteries, which may be common to both systems.

There should be two separate starter batteries, each having a rated voltage of not less than 12 V, each provided with an independent, continuously connected, fully automatic, constant potential charger (clauses 10.9.7.3 and 10.9.7.1 of *BS EN 12845: 2004* refer).

Clause 10.9.7.2 of *BS EN 12845: 2004* recommends that the automatic starting system for the pumpset should make six attempts to start the engine, each one of 5 s to 10 s duration. After each starting attempt the system shall switch over to the other battery. The supply for the control system is to be drawn from both batteries simultaneously. The batteries are not to supply the starter motor at the same time. Additionally, there shall be a facility to ensure that one battery shall not have an adverse effect on the other.

In addition to the requirements of *BS EN 12845: 2004* for automatic starting a manual means of starting the diesel engine should be provided. The manual start test button shall only be available and accessible for operation after an automatic start followed by a shutdown or after six repeated unsuccessful attempts to start automatically (clauses 10.9.7.3 and 10.9.7.4 refer).

BS EN 12845: 2004 recommends that the batteries and chargers for the starting system should be situated on stands in readily accessible positions as close as possible to the engine starter motor in order to minimize volt drop (clause 10.9.10 refers).

2.2 Switchgear and controlgear

Where a water sprinkler system is installed, the main switchboard from which the electrically driven pumpset gets its supply should be situated in a fire compartment which is used for no other purpose than for electrical power supplies (clause 10.8.3.1 of *BS EN 12845: 2004* refers).

The supply to the sprinkler system pumpset is to be used solely for that purpose and additionally, the isolating switch of this dedicated power supply should be lockable‡.

The electrical connections in the main switchboard should be arranged so that the supply to the pump controller is not isolated when other services are isolated. Additionally, the fuses in the pump starter are to be of high breaking capacity¶ and capable of carrying the starting current for a period of no less than 20 s (clauses 10.8.2.1 and 10.8.2.2 of *BS EN 12845: 2004* refer).

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‡ Although not clearly stated by *BS EN 12845: 2004* it is likely that the switch would be lockable in both the ON and OFF position. In normal operation the switch would be locked ON to ensure that no tampering takes place. When maintenance is to be carried out the switch would be locked OFF to permit safe working.

¶ For further details on high breaking capacity fuses refer to Topic ***C33-5*** CARTRIDGE FUSES - High breaking capacity (*BS 88, BS 1361*).

For the period that a sprinkler system pump would be in operation, and because it would be undesirable for the pump to cease operation through the operation of an overload device, it is unlikely that overload protection would be required for the circuit. Specifically, Regulation 560.7.3 permits the overload protection prescribed in Regulations 433.3.3 to be omitted.

Clause 10.8.3.2 of *BS EN 12845: 2004* requires that each disconnecting device on the dedicated feed to the sprinkler pump is labelled 'SPRINKLER PUMP MOTOR SUPPLY – NOT TO BE SWITCHED OFF IN THE EVENT OF A FIRE'. These words should be in letters of not less than 10 mm height and shall be white on a red background.

3. Foam systems

Foam extinguishes a fire by forming a blanket over the surface of a burning liquid. Low expansion foam systems are not generally used for running-fuel fires, such as may be the case where fuel is escaping from a leaking container, or for destructive liquids, such as alcohol, which cause rapid breakdown of the foam.

BS 5306-6.1: 1988 Fire extinguishing installations and equipment on premises – Part 6: Foam systems – Section 6.1 Specification for low expansion foam systems provides detail on the specific requirement for foam systems.

The electrical installations for this type of system relate to electrically driven pumps and to the automatic detection and control equipment that is linked with the fire detection and alarm system to *BS 5839*. Refer to Topic ***S13-20*** for information on fire alarm systems.

The commentary on clause 14.3 of *BS 5306-6* expresses a preference for diesel driven pumps. Where electrically driven pumps are used, multiple pumps should be installed to ensure reliability of operation or, alternatively, an independent standby supply should be provided. Where electrically driven pumps are used there should be both an automatic facility for starting the pump and a manual start button.

For manually starting diesel driven pumps, an electric starter with a manual switch or a manually operated mechanical starter should be provided (commentary to clause 14.3 of *BS 5306-6* refers).

Clause 14.3 of *BS 5306-6* recommends that switches on the electricity supply to the circuit must be labelled 'Fire equipment – pump motor supply – not to be switched off during fire emergency'. The lettering should be a not less than 15 mm high and be coloured white on a red background, with the letter 'F' being the only one capitalized.

4. Gaseous flooding systems

Different types of gas extinguish fires in different ways. A halon-based system uses the combustion process itself to extinguish the fire without removing oxygen from the air, whilst a carbon-dioxide or argon system removes oxygen from the air.

The Montreal Protocol is an international agreement that binds the signatories to reduce the amount of ozone depleting substances. Although halon-based substances have excellent fire extinguishing and suppression properties, halon is to be phased out because it has high ozone depletion potential (ODP). By 2010 the manufacture of halon-based substances is prohibited.

There is a risk to persons and livestock from the use of any gaseous flooding system. For further information specialist advice should be sought.

BS 7273-1: 2000 Code of practice for the operation of protection measures – Part 1: Electrical actuation of gaseous total flooding extinguishing systems provides information on the electrical actuation of gaseous flooding systems.

The power supplies for a fire extinguishing system should comply with the recommendations of both *BS 5839-1* and *BS 7671*. The note to clause 8.1 of *BS 7273-1* permits a common power supply for the extinguishing system and the fire detection and fire alarm system, provided there are no adverse interactions between them. However, clause 6.4.3.1 of *BS ISO 14250-1: 2006 Gaseous fire-extinguishing systems – Physical properties and system design – Part 1: General requirements* requires that the electric power supply shall include an emergency secondary power supply with automatic changeover in case the primary supply fails.

A fire extinguishing system will be designed for either manual or automatic operation. Where automatic operation exists, there is a requirement that there is provision for manual operation as well, (clause 6.4.1 of *BS ISO 14520: 2006* refers).

Clause 6.4.3.1 of *BS ISO 14250-1: 2006* requires that automatic systems are controlled by the fire detection and actuation systems suitable for the particular hazard. Additionally, the electrical power supply for the electrical detection, alarm and release devices should be separate from, and independent of, the supply for the hazardous area.

Topics referred to in this text:

C33-5	CARTRIDGE FUSES: High breaking capacity (*BS 88, BS 1361*)
S13-11	SAFETY SERVICES: Requirements for circuits, general
S13-20	SAFETY SERVICES: Requirements for fire alarm systems for buildings other than dwellings
S13-23	SAFETY SERVICES: Requirements for sources, general

Topics not referred to in this text, which are related and may be of interest:

F45-9	FIRE DETECTION AND ALARM SYSTEMS: Circuit segregation requirements
F45-21	FIRE DETECTION AND ALARM SYSTEMS: Fire resisting cables in systems of buildings other than dwellings
S13-14	SAFETY SERVICES: Requirements for emergency lighting systems
S13-21	SAFETY SERVICES: Requirements for fire alarm systems for dwellings

***BS 7671* (Requirements for electrical installations)**

Some of the most important requirements are found in:

Protection against overcurrent	Chapter 43
Safety services	Chapter 56