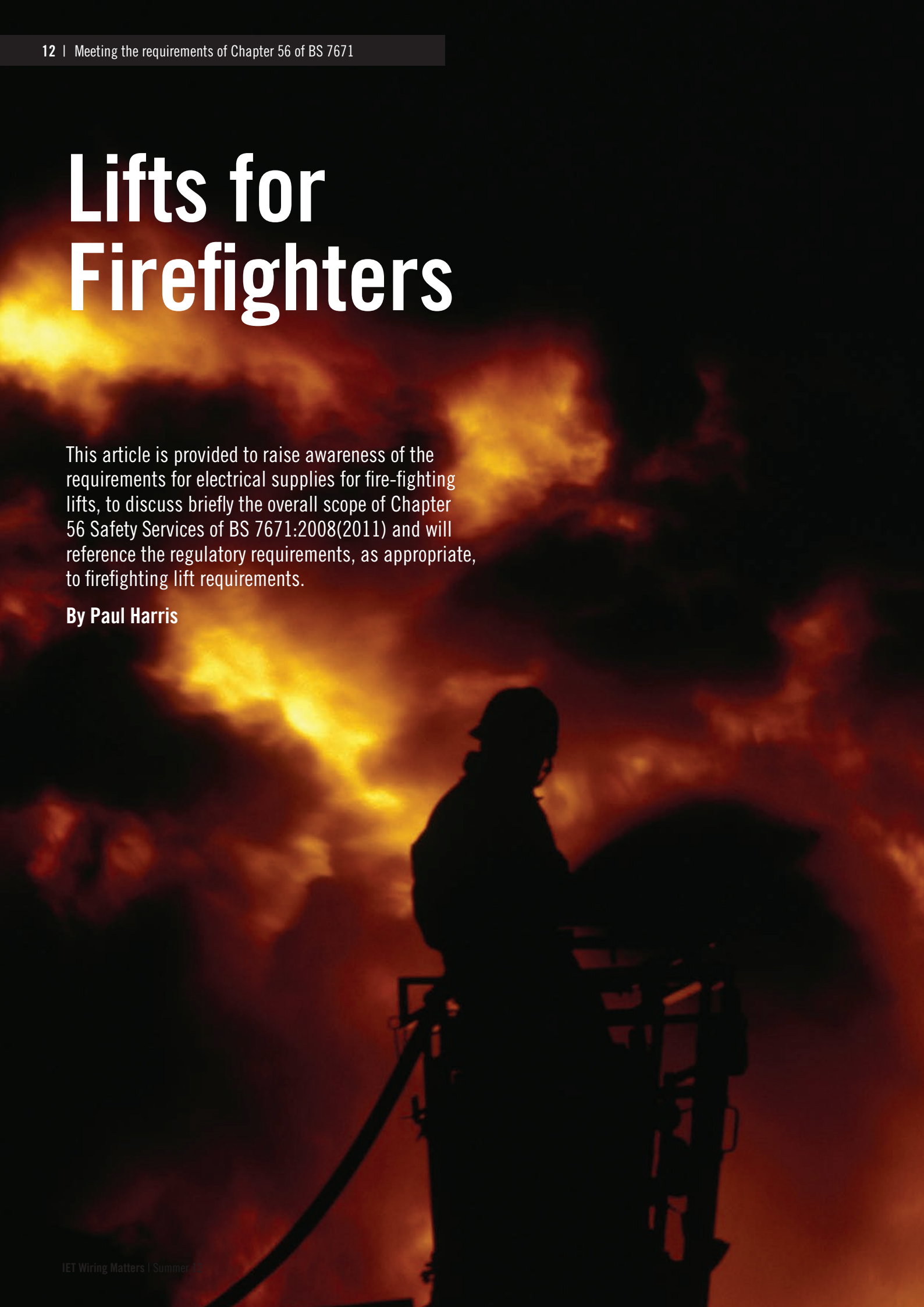
Lifts for Firefighters

This article is provided to raise awareness of the requirements for electrical supplies for fire-fighting lifts, to discuss briefly the overall scope of Chapter 56 Safety Services of BS 7671:2008(2011) and will reference the regulatory requirements, as appropriate, to firefighting lift requirements.

By Paul Harris



There appears to be a common area of misunderstanding leading to incorrectly designed supplies which result in firefighting lift installations not being fully compliant with BS 7671, in particular, Chapter 56 and the requirements for firefighters lifts contained in BS EN 81-72: Lifts for Firefighters.

When carrying out an electrical design and/or installation, it will at some point be necessary to certify compliance with BS 7671 for the entire electrical installation. This will include the certification of the safety services and, in particular, the firefighting lift supply.

Failure to design or install the supplies correctly will not only jeopardise the integrity of the Electrical Installation Certificate, it may have an effect on the persons using the firefighting lift in onerous conditions.

Chapter 56 Safety Services – BS 7671

Whilst it excludes hazardous areas, Chapter 56 covers within its scope a large number of subject areas:

- Emergency lighting
- Fire pumps
- Fire rescue service lifts
- Fire detection and alarm systems
- CO detection and alarm systems
- Fire evacuation systems
- Smoke ventilation systems
- Fire services communication systems
- Essential medical systems
- Industrial safety systems.

The subject areas addressed in the scope of Chapter 56 have many Codes of Practices and their own supporting British Standards.

Building Regulation Requirement for Firefighting Lifts

A firefighters lift is defined as: "a lift installed primarily intended for passengers use which has additional protection, controls and signals which enable it to be used under the direct control of the fire service".

The design of new buildings requires compliance with Building Regulations for England and Wales, which includes Approved Document B (Fire Safety). To meet the requirements of Building Regulations, Approved Document B (AD B), BS 9999 Code of Practice for Fire Safety in the design, management and use of buildings provide an abundance of best practice information for building designers and managers to use to discharge their responsibilities under the Building Act.

(Building Regulations vary throughout the UK, this article focuses on England and Wales. However, in Scotland ▶

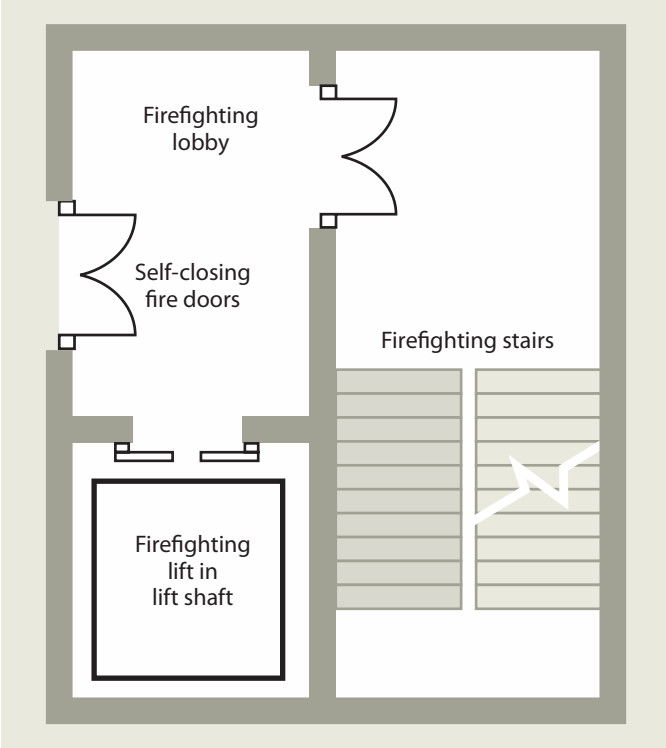


Fig 1 - Fire-fighting Shaft with Fire-fighting Lift

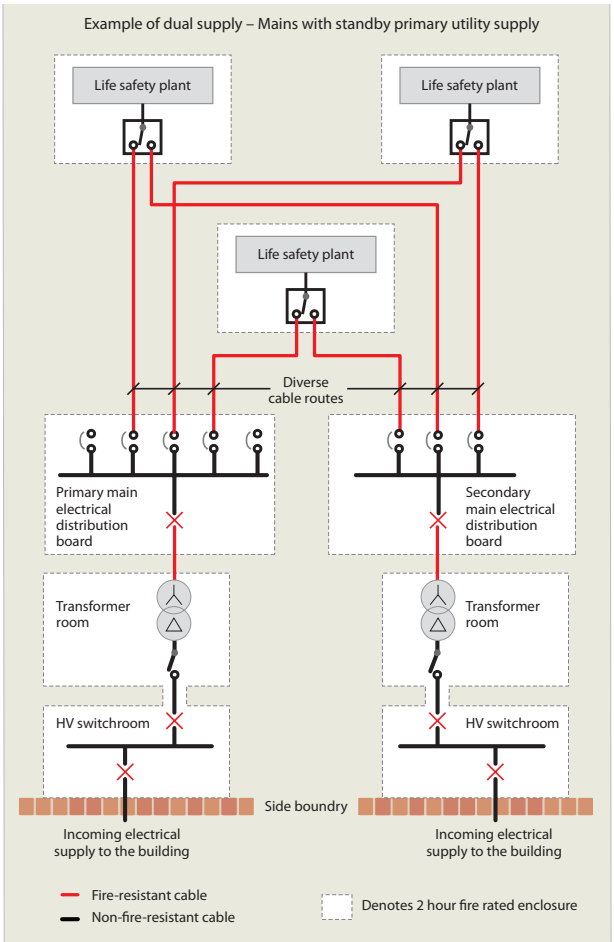


Fig 2 - Indicates a life safety arrangement utilising an alternative HV supply

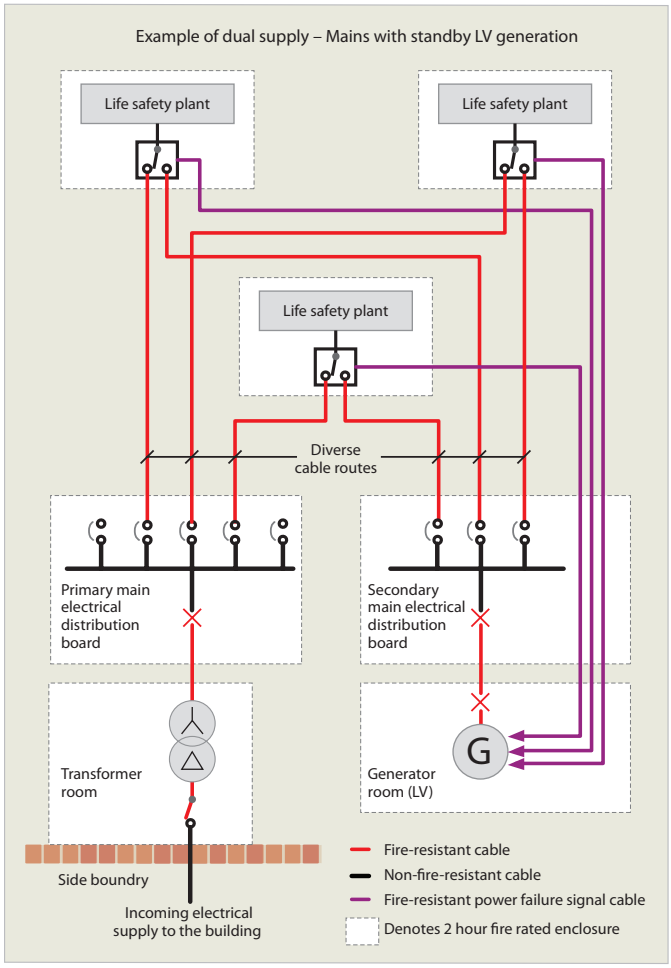


Fig 3 – Extract from BS 8519, Example of dual supply, mains with standby LV generation

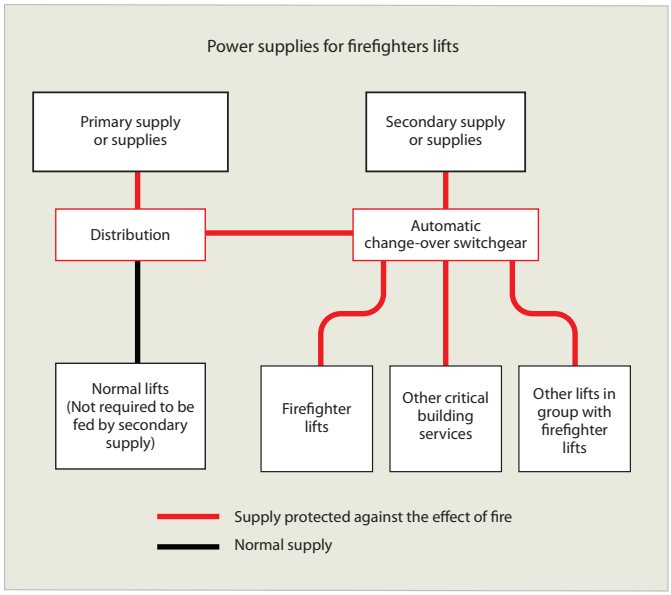


Fig 4 – Power supplies for Firefighters lifts

◀ the Building Standards are supported by Technical handbooks, www.scotland.gov.uk/Built-Environment/Building/Building-standards/ and for Northern Ireland DFP Booklet E 2005 www.dfpni.gov.uk)

Table 19 of BS 9999 sets out the provision of firefighting shafts, and details additional mitigating measures to use as the level of difficulty to access the fire increases.

The requirement for the firefighting lift(s) is set out by the Building Control Officer, Approved inspector or the Project Fire Engineer as part of method of satisfying the requirements of Approved Document B and BS 9999.

Firefighting lifts are usually required in any building or part of a building where the upper most storey is greater than 18m above floor level or where the depth of the surface of the floor of the lower most storey exceeds 10m.

Additional firefighting lifts are required where the floor area exceeds 900m^2 or the requirements for the development determine the number of lifts for firefighting purposes.

Lifts for firefighting purposes are provided to assist firefighters arriving with equipment and additional personnel to fight the fire in as short a time as possible and those lifts should not be confused with evacuation lifts.

Firefighting lifts may contain many of the same features as an evacuation lift, although it may not preclude the fire and rescue service evacuating disabled or impaired persons if necessary; Fig.1 indicates a typical firefighting shaft arrangement.

Outline requirement of BS EN 81-72

Once it has been determined that a firefighting lift is required the designer should consult the specific requirements of BS EN 81-72: Lifts for Firefighters, which is part of the BS EN 81 series of documents relating to passenger and goods lifts.

There are many requirements and restrictions placed on the lift car: the shaft design, location with respect to water, types of flooring and accessibility to the fire. However, these are usually dealt with as part of the construction/structural design of the building with input from the lift manufacturer.

This does not negate the electrical designer's need to understand the general requirements which are set out in the aforementioned standards.

There are a number of principal requirements that are in the direct control of the electrical designer. These are:

- the equipment in machinery spaces are protected from water;
- the secondary power supply is located in a fire ▶

protected area;
- the primary and secondary power supplies are separated from each other and other power supplies;
- the primary and secondary power supplies are fire protected to the same level as the lift well equipment.

Specific risks and hazards will be particular to each individual project. In addressing these, a number of other considerations need to be made and the following questions answered:

- What type of secondary supply is appropriate for this building?
- What routes are fire protected and which are likely to give suitable segregation from each other?
- Where can the lift supply changeover equipment be installed?
- What fire survival time can be used to ensure compliance?
- How does BS 8519 impact the sizing of the firefighting lift cables and overall system?

At this point any potential proposals should be checked with the requirements of BS 9999 and BS 7671 to ensure compatibility.

Electrical design requirements
Primary supply
In addressing the above points it is important to assess the primary electrical supply position. Unless the supply enters a fire-resistant switchroom directly from outside, it is likely to be affected by fire within the building.

Where the incoming supply cable passes through a basement or other occupied area to reach the meter or switchgear position, consideration should be given to how the incoming section of the electrical supply will be affected if the building is on fire.

Where required, fire segregation will be needed by either enclosing in fire-resistant materials or by routing the cable through a fire resistant duct or riser. The performance criteria for various types of fire resistant enclosures is given in BS EN 1366, which for firefighting lift supplies, requires a 120-minute fire-protection period and an additional requirement to withstand the effects of water jets at the conclusion of the period.

If the cable belongs to a utility company, fire protection or re-routing may not be possible without a specific agreement. Regardless of ownership, the size of a cable may need to be increased due to the effects of enclosing the cable in a duct or similar.

A fundamental principal of safety services, in particular firefighting lifts, is that any distribution or final circuit supplying the firefighting lift(s) shall be exclusive to the lift(s) and independent of any other main or distribution circuit feeding other circuits.

BS 7671 considers a safety source to be additional to the normal source, which is generally the public supply network. This approach differs to safety services contained in BS EN 81-72 and BS 8519 as they consider the primary supply to be of equal importance to the secondary supply.

Secondary supply
The secondary supply to the firefighting lift may be by the provision of a separate supply from an independent substation, remote from the primary supply; as indicated in Fig. 2. Where such a supply is provided it is normally at high voltage (HV). BS 9999 recognises this arrangement is usually quite difficult to obtain unless strict measures are in place to prevent the supply network becoming inappropriately interconnected through the customer's installation.

The more usual approach of providing a secondary supply is to use a generator. This is a reliable method as it does not rely on special approvals from the electricity supply company.

There is a break in supply with this system, which is due to the machine sensing loss of supply, starting the engine and then running the alternator up to synchronous speed to changeover.

This type of break is classified by BS 7671 as a medium break in Regulation 560.4.1. Care needs to be taken when selecting a generator for secondary supplies as the initial load acceptance on change-over (first step) is in the region of 60 per cent of the full-load rating.

Regulation 560.6.1 allows other sources of power, such as storage cells and primary cells, to be used as safety supplies. Due to the nature and magnitude of the firefighting lift load, these sources are not usually considered. Fig. 3, which is an extract from BS 8519 indicates a life safety arrangement utilising a generator.

Whichever solution is chosen, it is important to ensure that the primary and secondary supplies are not co-located and they are not dependent upon each other in accordance with Regulation 560.7.1, i.e. they do not share distribution circuits, protective devices or other electrical equipment.

As with the primary supply, a fire-protected enclosure is required to protect the alternative supply from the effects of fire and water jets. With a generator solution additional measures with respect to air intake and exhaust discharges have to be considered in line with Regulation 560.6.4 of BS 7671.

Changeover equipment location
In order that the supplies remain independent of each other, the changeover equipment should be sited as close to the lift drive and control equipment as possible, which would be within the fire rated construction of the firefighting shaft. This would ideally be in the same room/compartment, which by design should be free from the effects of water and allows maximum segregation of the supplies providing the level of protection called for in clause 5.7.1 of BS EN 81-72.

In addition to the protective requirements of Regulation 560.6.14 , BS 8519 requires the status of the safety service to be monitored to confirm both primary and secondary supplies are available at an appropriate location such as the fire control/command point in a building.

Fire Survival times
Regulation 560.5.2 states:

"For safety services required to operate in fire conditions, the following two conditions shall be fulfilled:

(i) An electrical safety source for safety supply shall be so selected as to maintain a supply of adequate duration, and

(ii) all equipment of safety services shall be so provided, either by construction or by erection, with protection ensuring fire resistance of adequate duration"

The fire survival time of a system is set out in BS 8519 as 60 minutes for large or complex buildings and 30 minutes for other buildings. Firefighting systems have additional requirements placed on them, with the systems installed being capable of assisting fire fighters for 60 minutes or 120 minutes depending on their role. Table 1 of BS 8519 identifies that firefighting lift supplies and their communications cabling shall have a minimum of Category 3 fire resistance. This is in line with the requirements of Regulation 560.8.2 which requires cables that control safety services are to have the same level of fire protection as the supply it is controlling.

Category 3 cables over 20 mm overall diameter meet the 120 minute survival time when tested in accordance with BS 8491, or control cables meeting ph120 classification when tested in accordance with BS EN 5020.

Selection of firefighting lift supply cables

In order to correctly size a fire resistant cable for firefighting purposes, it is important to consider the size of the fire and the amount of cable that may be potentially exposed to a fire. These factors will significantly affect the performance of a fire rated cable over those values used in normal cable sizing and volt drop calculations.

In order to meet the ▶

◄ requirements of BS 8519 and the functionality called for in Regulation 560.5.2, information within informative Annexes C and D of BS 8519 needs to be considered to ensure that equipment is able to function under the onerous conditions experienced in a fire.

In selecting a cable to supply the firefighting lift supplies, it is essential to note the requirement for a 120 minute fire rated cable. This requirement of 120 minutes restricts the number of products currently available on the market. However, it is not just a case of selecting a fire resistant cable, choices of route and which other services are to run with the firefighting lift supplies are crucial.

In addition to the usual assessment of full load operating current of the firefighting lift it is important to look at the potential exposure of the cable to fire. In taking into account any increase in impedance and, hence, volt drop, it is ideal to protect cables from the effect of heat from the fire. Where it is not practical or possible, the next approach should be to limit the length of run in any one fire compartment.

Information and examples in informative Annexe C of BS 8519 allow the designer to determine the approximate level of volt drop under fire conditions. Once this value has been determined it should then discussed with the equipment manufacturer to ensure that the requirements of Section 525 of BS 7671 are met. Where necessary, cable sizes should be increased to ensure function of equipment throughout the fire condition as required meeting the requirements of BS 8519 and required by Regulation 560.5.2.

In order to ensure that the requirements for firefighting lifts are met, the principal requirements have been simplified and summarised by the diagram in Informative Annexe (C) BS EN 81-72.

BS EN 81-72 Electrical Supply Requirements - Simplified

The principal issues relate to the requirement for the segregation of the supply from other circuits and fire protection to the same level as the lift shaft and segregation from the alternative supply; this is highlighted in Fig.4.

The requirements of BS 7671 cannot be overlooked when designing particular safety services. It can be seen that the Wiring Regulations provide a regulatory framework for designers and installers to work with. The individual requirements must be fully considered to achieve compliance and discharge the relevant duties in law.

In the instance of electrical supplies the specific requirements are generally set out in BS 9999, with details of solutions contained in BS EN 81-72 and BS 8519. These specific details allow regulatory compliance with BS 7671 to be achieved. This allows the designer, constructor and inspector to confirm compliance with BS 7671 on the main Electrical Installation Certificate, meeting the express and implied requirements contained within BS 7671.

This article is not aimed to be a complete and comprehensive selection guide for the installation of firefighting lift design, it is provided to create awareness of different standards and guide designers and installers towards the correct information sources. It is the responsibility of the designer to ensure they have adequately assessed all relevant risks using reasonable skill and care.■

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