## Contents

### FOREWORD

<table>
<thead>
<tr>
<th>1</th>
<th>LEGISLATION AND STANDARDS</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Fire safety legislation</td>
<td>6</td>
</tr>
<tr>
<td>1.1.1</td>
<td>Training</td>
<td>7</td>
</tr>
<tr>
<td>1.2</td>
<td>Pressure vessel legislation</td>
<td>8</td>
</tr>
<tr>
<td>1.3</td>
<td>Manufacturing standards</td>
<td>9</td>
</tr>
<tr>
<td>1.3.1</td>
<td>BS EN 3</td>
<td>9</td>
</tr>
<tr>
<td>1.3.2</td>
<td>Colour coding</td>
<td>10</td>
</tr>
<tr>
<td>1.3.3</td>
<td>BS 6165</td>
<td>11</td>
</tr>
<tr>
<td>1.3.4</td>
<td>BS EN 1802, BS EN 1803 and BS EN 1968</td>
<td>11</td>
</tr>
<tr>
<td>1.4</td>
<td>Commissioning, installation and maintenance standards</td>
<td>11</td>
</tr>
<tr>
<td>1.4.1</td>
<td>BS 6643-1 and 2</td>
<td>12</td>
</tr>
<tr>
<td>1.5</td>
<td>Third party accreditation schemes</td>
<td>12</td>
</tr>
</tbody>
</table>

### CLASSES OF FIRE AND FIRE SCIENCE

<table>
<thead>
<tr>
<th>2</th>
<th>CLASSES OF FIRE AND FIRE SCIENCE</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Fire science</td>
<td>13</td>
</tr>
<tr>
<td>2.1.1</td>
<td>The Fire Triangle</td>
<td>14</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Temperatures</td>
<td>14</td>
</tr>
<tr>
<td>2.1.3</td>
<td>Fire spread</td>
<td>15</td>
</tr>
<tr>
<td>2.1.4</td>
<td>Suppression methods</td>
<td>16</td>
</tr>
<tr>
<td>2.2</td>
<td>Classes of fire</td>
<td>16</td>
</tr>
</tbody>
</table>

### EXTINGUISHER CONSTRUCTION

<table>
<thead>
<tr>
<th>3</th>
<th>EXTINGUISHER CONSTRUCTION</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Extinguisher design</td>
<td>18</td>
</tr>
<tr>
<td>3.1.1</td>
<td>Stored pressure</td>
<td>19</td>
</tr>
<tr>
<td>3.1.2</td>
<td>Gas cartridge</td>
<td>19</td>
</tr>
<tr>
<td>3.2</td>
<td>Extinguisher ratings</td>
<td>21</td>
</tr>
</tbody>
</table>

### TYPES OF EXTINGUISHER

<table>
<thead>
<tr>
<th>4</th>
<th>TYPES OF EXTINGUISHER</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Water</td>
<td>22</td>
</tr>
<tr>
<td>4.2</td>
<td>Foam</td>
<td>24</td>
</tr>
<tr>
<td>4.3</td>
<td>Powder</td>
<td>26</td>
</tr>
<tr>
<td>4.4</td>
<td>Carbon dioxide</td>
<td>28</td>
</tr>
<tr>
<td>4.5</td>
<td>Wet chemical</td>
<td>30</td>
</tr>
<tr>
<td>4.6</td>
<td>Halon</td>
<td>31</td>
</tr>
</tbody>
</table>
Contents

5 SITING AND PROVISION 32
  5.1 How many? 34
  5.2 Class A risks: 0.065 calculations 34
    5.2.1 Single occupancy 34
    5.2.2 Multiple occupancy 34
    5.2.3 Worked example 34
  5.3 Class B risks 34
  5.4 Siting requirements 36

6 COMMISSIONING AND SERVICING PROCEDURES 38
  6.1 Practical considerations 39
    6.1.1 Specifying suitable extinguishers 39
    6.1.2 Appointing a competent service technician 39
    6.1.3 Written reports and documentation 40
    6.1.4 Halon and non-compliant extinguishers 41
  6.2 Commissioning 41
  6.3 Servicing schedules 41
    6.3.1 User inspections 41
    6.3.2 Inspection periods 42
    6.3.3 Recharging 42
    6.3.4 Disposal of medium 44

FURTHER INFORMATION 45

INDEX 47
Portable fire extinguishers are a vital part of the fire protection armoury, their role being to extinguish or contain a fire until evacuation has been achieved and the fire service is able to intervene. First-aid firefighting with an appropriate portable extinguisher can effectively stop a small fire from growing into a large fire, significantly reducing fire losses. It is therefore critical to select the right extinguishers, then correctly position and maintain the equipment.

This useful guide provides the end-user with information about how to choose, use and site fire extinguishers. It also offers advice on the maintenance and servicing requirements, to ensure that every portable extinguisher is operational and ready for use at all times.

The document provides an introduction to the requirements of UK fire legislation, explaining that a risk assessment must be conducted in every workplace to identify what firefighting equipment is necessary. It also highlights the importance of providing appropriate fire training to employees.

It offers an introduction to extinguisher construction, describing how each type of extinguisher works and emphasises the need for regular maintenance by a competent, third party accredited contractor. An overview of the servicing procedures is also provided to assist end-users and service technicians alike to understand the necessary checks that ensure extinguishers will operate safely whenever required.

The FPA should be commended for producing this simple guide, which I am sure will offer useful assistance to all people involved in specifying, using and arranging for the maintenance of fire extinguishers.

**Neil Taylor**  
Managing Director, Chubb Fire Ltd
Most of us are aware of the legislative need to comply with fire safety regulations in the workplace, though we may not be sure which regulations apply. A rationalisation of fire safety legislation was introduced throughout the UK on 1 October 2006. Although the law is built on the basis of fire risk assessment, the legislation has been (or will be, in the case of Northern Ireland) introduced slightly differently across England and Wales, Scotland, and Northern Ireland.

1.1 Fire safety legislation
In England and Wales, the relevant legislation is the Regulatory Reform (Fire Safety) Order 2005. In Scotland, the relevant legislation is two-fold, being Part 3 of the Fire (Scotland) Act 2005 and the Fire Safety (Scotland) Regulations 2006. In Northern Ireland, the relevant legislation will be Part 3 of the Fire and Rescue Services (Northern Ireland) Order 2006 and the Fire Safety (Northern Ireland) Regulations 2006. In Northern Ireland, the legislation is still subject to commencement orders.

In essence, each of the above pieces of legislation has the same intention: to ensure that all ‘relevant persons’ will be safe should a fire occur in ‘relevant premises’. Enhanced provisions may be necessary to ensure property protection too. The following important terms are generally defined in all parts of the UK:
• ‘relevant persons’ are any persons who are legally within ‘relevant premises’ or any persons who are or may be in the vicinity of ‘relevant premises’; and
• ‘relevant premises’ are essentially any premises other than a single domestic residence.

These pieces of legislation also describe the necessary provision of fire protection equipment within the workplace.

Article 13(1) of the Regulatory Reform (Fire Safety) Order 2005 requires that:
‘(a) the premises are, to the extent that is appropriate, equipped with appropriate firefighting equipment, fire detectors, and alarms; and
(b) any non-automatic firefighting equipment that is provided is easily accessible, simple to use, and indicated by signs.’

Article 13(3) states that the responsible person must, where necessary:
‘(a) take measures for firefighting in the premises, adapted to the nature of the activities carried on there and the size of the undertaking, and of the premises concerned; (b) nominate competent persons to implement those measures and ensure that the number of such persons, their training and the equipment available to them are adequate, taking into account the size of, and the specific hazards involved in the premises concerned; and
(c) arrange any necessary contacts with external emergency services, particularly as regards firefighting, rescue work, first aid, and emergency medical care.’

The ‘responsible person’ is the person or persons responsible for, or having effective control over, fire safety provisions adopted in or appropriate to the premises or building or risk. A ‘competent person’ is defined in the Fire Safety Order as someone who ‘has sufficient training and experience or knowledge and other qualities to enable him properly to implement the measures’.

Similar provision is made in Scotland in Articles 12(1) and 12(3) of The Fire Safety (Scotland) Regulations 2006, and will be made in Northern Ireland.

Therefore, consideration must be given to the provision of appropriate firefighting equipment. This is determined by the size, nature, and use of the workplace and the activities undertaken, recognising materials and the maximum number of people likely to be present. The responsible person has to take measures for firefighting, nominate a competent person to implement those measures, and establish contacts with the emergency services.

1.1.1 Training
Where the fire risk assessment identifies that firefighting equipment is necessary to safeguard people, the responsible person must ensure that the premises are appropriately equipped. Where portable firefighting equipment is deemed necessary, the responsible person must also nominate a sufficient number of people to use it, and ensure that they receive adequate training. A fire risk assessment that aims to ensure property protection and business continuity, in addition to life safety, may identify a need for an enhanced level of firefighting equipment and more trained operators.
Training can be given either individually or in small groups. Routine maintenance of equipment and fire drills provide suitable opportunities for training, particularly where extinguishers have to be discharged as part of the maintenance procedures. Some employees may be more likely to have to use fire equipment and their training must be given priority. These include:

- night watchmen, caretakers, security staff, patrol staff;
- those working where few other staff are around;
- people working on processes or in situations that are hazardous; or
- anyone working where there are flammable liquids, who should be trained to deal with difficult and dangerous flammable liquid fires.

Members of an occupational fire brigade or factory fire team will obviously need more thorough training.

People with no training should not be expected to attempt to use a fire extinguisher. However, all staff should be familiar with the location and basic operating procedures for the portable extinguishers located in your premises.

It should be explained to staff, during training sessions, that they may only attempt to tackle a fire if they are confident that they may do so without risk to themselves or to anybody else. In particular, they should not:

- attempt to fight a fire on their own;
- let the fire come between them and their means of escape;
- continue to fight the fire if it continues to grow or if it threatens to spread to containers or cylinders of flammable gases or highly flammable liquids, including aerosol containers; and
- continue to fight the fire if their initial attempts have not been successful.

Fire safety instruction should begin on employees’ first day as part of induction training. Follow-up training sessions should include instruction on the appliances available and practical guidance on their use.

1.2 Pressure vessel legislation

The Pressure Equipment Regulations 1999 are the UK regulations covering the requirements of the Pressure Equipment Directive into UK law. They relate to the assurance of the safety of new pressure equipment and include all portable fire extinguishers.

Portable fire extinguishers, compliant with the relevant part of the revised BS EN 3 standard and tested as compliant by a notified body, such as British Standards Institution (BSI), are likely to meet the requirements of the Pressure Equipment Regulations. The following legislation is relevant:

- Statutory Instrument 2009 No. 1348: The Carriage of Dangerous Goods and Use of Transportable Pressure Receptacles Regulations 2009; and
1.3 Manufacturing standards

In the UK, the construction of fire extinguishers is covered by two standards – BS EN 3: Portable fire extinguishers and BS 6165: Specification for small disposable fire extinguishers of the aerosol type. The latter standard mainly covers the smaller size of fire extinguisher, while BS EN 3 covers fire extinguishers from 1kg to 12kg and 2-litres to 9-litres capacity. BS 7863: Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers provides recommendations on colour coding of extinguishers. Standards are regularly updated and the current version should be used.

Carbon dioxide extinguishers must also meet the requirements pressure vessel legislation (see 1.2 above) and of BS EN 1802: Transportable gas cylinders. Periodic inspection and testing of seamless aluminium alloy gas cylinders, BS EN 1803: Transportable gas cylinders. Periodic inspection and testing of welded carbon steel gas cylinders and BS EN 1968: Transportable gas cylinders. Periodic inspection and testing of seamless steel gas cylinders.

1.3.1 BS EN 3

The manufacture of portable fire extinguishers is governed by several parts of BS EN 3. The standard is of more relevance to extinguisher manufacturers than the end user or installer but it specifies in detail the extinguisher characteristics, duration of operation, any residual charge, and the efficiency testing of portable fire extinguishers. The relevant parts are:

- BS EN 3-7: Portable fire extinguishers. Characteristics, performance requirements and test methods;
- BS EN 3-8: Portable fire extinguishers. 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 EN 3-9: Portable fire extinguishers. Additional requirements to EN 3-7 for pressure resistance of CO₂ extinguishers; and
- BS EN 3-10: Portable fire extinguishers. Provisions for evaluating the conformity of a portable fire extinguisher to EN 3-7 – in preparation, will supersede BS EN 3-6.

BS EN 3 defines a fire extinguisher as an ‘appliance containing an extinguishing medium which can be expelled by the action of internal pressure and be directed on to a fire’. A portable extinguisher is defined as ‘a fire extinguisher which is designed to be carried and operated by hand and which in working order has a mass of not more than 20kg’.

The standard explains that portable fire extinguishers are described by the type of extinguishing medium they contain, defining current types as:

- water-based;
- foam;
- powder; and
- carbon dioxide.

It also refers to halon, which is now only available for critical uses, and clean agent, for which no extinguishers are available in the market. It specifies a minimum operation time for each size and type of extinguisher.
All fire extinguishers and cartridges have to hold a predetermined charge, which can be checked in several ways. In carbon dioxide extinguishers, the retention of charge is checked by weighing the extinguisher. Stored pressure extinguishers are fitted with some type of connection to allow the internal pressure to be tested. Extinguishers may also have a built-in pressure gauge.

Definitions are laid down as to acceptable leakage levels and significant leakage levels. There is also a dielectric test for certain water-based extinguishers to establish their suitability for use on live electric equipment, by measuring the conductivity of the discharge stream from the extinguisher. Powder extinguishers are subject to a compaction test to ensure that compaction of the powder will not prevent extinguishers from operating effectively.

All extinguishers have to be fitted with a valve to enable the operator to interrupt the flow of extinguishing medium temporarily and all extinguishers must operate in the upright position without the need to invert them in order to commence operation. To help control flow, operating levers are located on the upper parts of the extinguisher or at the of the nozzle and, if a charge of over 3kg or 3 litres is used, a discharge hose at least 400mm long has to be fitted. An extinguisher must be able to stand freely and/or be able to be fixed to a vertical surface and each extinguisher should be marked with the name of the manufacturer, a serial or batch number, the year of manufacture and the test pressure in bar.

BS EN 3 also specifies the size of charges in portable fire extinguishers and the minimum quantity of extinguishing medium that can be used to extinguish a fire of a given size. Other features – like characteristics of effective operating temperatures, requirements for components, resistance to corrosion, brackets, extinguisher identification and periodical checking – are defined, making BS EN 3 a comprehensive standard.

### 1.3.2 Colour coding

Extinguishers bodies are often coloured predominantly red, although polished metal types are available. They should carry a coloured zone of 3-10% of the external area to indicate the type of extinguishing medium used. Recommendations for the location of the colour indication and the colour-coding to be used are contained in BS 7863: *Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers* (see Table 1).

#### Table 1: Colour coding for extinguishing media (adapted from BS 7863 Table 1)

<table>
<thead>
<tr>
<th>Extinguishing media</th>
<th>Colour</th>
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<tbody>
<tr>
<td>Water</td>
<td>Red</td>
</tr>
<tr>
<td>Foam</td>
<td>Pale cream</td>
</tr>
<tr>
<td>Powder (all types)</td>
<td>Blue</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Black</td>
</tr>
<tr>
<td>Wet chemical</td>
<td>Canary yellow</td>
</tr>
<tr>
<td>Clean agent (including halons)</td>
<td>Green</td>
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</table>
The requirements of BS EN 3 and BS 7863 apply to new extinguishers only.

The previous standard, BS 5423 gave several options for the location of the identifying colour, permitting it to be over the whole extinguisher, over part of the extinguisher (with the body being the natural colour of the metal), or over part of the extinguisher (with the rest of the body being signal red). Since existing equipment does not need to be changed, portable firefighting equipment in the workplace may comply with either standard. It is good practice, however, for all fire extinguishers in an area or building to use the same colour coding system and method of operation.

1.3.3 BS 6165
This standard specifies requirements for non-refillable fire extinguishers of the aerosol type. This type of extinguisher has applications only in situations where small fires may occur and where the possibility of fire spreading to other materials is remote, or where people are present at the likely times of risk.

Since small disposable non-refillable fire extinguishers can be exposed to more severe environmental conditions, they are required to maintain their performance for longer periods than are other aerosol dispensers.

The standard states: ‘The extinguisher shall be marked with... the service expiry date which shall be not later than the end of the fifth year after filling’ and the instruction ‘Not to be refilled’. In other words, these extinguishers have a lifespan of no more than five years.

1.3.4 BS EN 1802, BS EN 1803 and BS EN 1968
These standards on transportable gas cylinders relate to seamless aluminium alloy gas cylinders, welded carbon steel gas cylinders and seamless steel gas cylinders. They specify the requirements for periodic inspection and testing to verify the integrity of the cylinders prior to being reintroduced into service. These standards require the tests to be carried out at 10-year intervals from the date of manufacture.

These tests are known by various names – such as hydraulic test, stretch test, or pressure test – and the tests must be conducted at an approved testing station.

1.4 Commissioning, installation and maintenance standards
The commissioning installation and maintenance requirements for portable fire extinguishers are described in BS 5306. The relevant parts are:

- BS 5306-3: Code of Practice for the commissioning and maintenance of portable fire extinguishers; and
- BS 5306-8: Fire extinguishing installations and equipment on premises. Selection and installation of portable fire extinguishers.

BS 5306-3 outlines guidelines for the initial commissioning of fire extinguishers, as well as schedules for maintenance and for the handling of obsolescent types of extinguisher (see Chapter 6). It describes the procedures relating to five levels of maintenance:

- commissioning;
- basic service;
- extended service;
- overhaul; and
- recharging.
It also provides guidance on the mounting and labelling of extinguishers and on the replacement of components, evaluating extinguishers’ fitness for service and the circumstances under which an extinguisher should be condemned.

BS 5306-8 provides guidance on the numbers and types of fire extinguishers to be installed, providing calculation methods to determine the number of fire extinguishers required (see Chapter 5). The calculation method is based on the fire extinguisher’s firefighting performance (fire rating) and not on the capacity of the medium within the fire extinguisher. Although the fire rating of the fire extinguisher is achieved by an experienced operator, the calculation takes into consideration the fact that an inexperienced operator will use the extinguisher in the actual fire situation. The standard provides guidance on the numbers of appropriate fire extinguishers. It also includes recommendations on the training of operators. British Standards are revised regularly and recommendation may alter.

1.4.1 BS 6643-1 and 2
BS 6643-1 and 2 specify the requirements for components, gas cartridges, propellants and refill charges for fire extinguishers manufactured to comply with BS 5423 and BS EN 3. In addition, requirements for the procedures to be followed are given. Attention is drawn to the use of the manufacturer’s specified refill charge to ensure the maintenance of the fire rating marked on the extinguishers.

1.5 Third party accreditation
Third party certification schemes for fire protection products and related services are an effective means of providing the fullest possible assurances, offering a level of quality, reliability and safety that non-certificated organisations may lack. Third party quality assurance can offer a means of satisfying the requirement that goods and services you have purchased are fit for purpose, and are a means of demonstrating that you have complied with the law.

To ensure the level of assurance offered by third party schemes, you should always check whether the company operates a quality management scheme that meets the requirements BS EN ISO 9001. This approval should be provided through the UK Accreditation Service (UKAS) with accreditation to BS EN ISO 17021.

BAFE is a not-for-profit organisation which promotes quality within the fire protection industry and operates a number of schemes that meet the above criteria. Schemes MP101: Manufacture of Portable Fire Extinguishers, SP101/ST104: Contract Maintenance of Portable Fire Extinguishers incorporating Registered Fire Extinguisher Service Technicians Scheme and SP103: Refurbishment of Portable Fire Extinguishers are designed to offer a comprehensive choice of fire extinguisher manufacturers and service organisations which operate throughout the UK.
To understand the basics of practical firefighting, it is important to first understand what combustion is and what factors must be present for combustion to occur. This chapter introduces the basic concepts of fire science, describing how fires start and spread. The different methods of fire suppression and the main classes of fire are also defined to help explain why certain extinguishants may be more effective for use on fires involving particular materials.

2.1 Fire science

Combustion can be defined simply as: ‘A chemical reaction evolving both heat and light energy’. However, three factors must be present in order to achieve combustion. These are: fuel, heat and oxygen. When all three factors are present in the correct proportions, combustion will occur.

This is often known as the Fire Triangle.
2.1.1 The Fire Triangle

**Fuel** – All matter exists in one of three states: solid, liquid or gas. Under normal conditions, almost anything will burn as fuel. The burning rate of a fuel depends on its configuration or state of division. Finely divided fuels, such as dust, powders or shavings, will absorb heat more rapidly than bulky materials because of the greater area that is exposed to heat. As a result, such fuels will liberate flammable vapours more quickly and so burn more readily.

Flammable liquids release vapour in much the same way as solid fuels. The rate of release is greater for liquids than solids, since liquids have less closely packed molecules and will vaporise more readily. The ease or degree of vaporisation will depend on the product – for example, petrol will vaporise more rapidly than fuel oils, which, in turn, will release vapours more readily than lubricating oil.

Flammable gases are already in the required vapour state. With an adequate mix of oxygen and heat, ignition will be achieved. A flammable gas must mix with oxygen within its range of flammability, otherwise ignition cannot take place.

If there is insufficient gas in the mixture, it is said to be too lean and will not burn. This would represent its Lower Explosive Limit (LEL). If the gas-to-oxygen mix is too great, then the mix is said to be too rich and, again, ignition will not take place. This is its Upper Explosive Limit (UEL). The percentage mixes between the two limits is called the explosive range of flammability.

**Heat** is required to act on a fuel in order to commence the chemical reaction, which will produce the flammable vapours required for combustion. The amount of heat required to raise a substance to its ignition temperature will vary depending on the substance involved.

**Oxygen** is a supporter of combustion and must be present before combustion can be achieved. Normally a 16-20% concentration of oxygen is required to support combustion, but there are products which, when subject to heat and the subsequent chemical decomposition, will liberate their own oxygen supply.

2.1.2 Temperatures

There are also three critical temperatures to consider in understanding and controlling firefighting operations: flash point; fire point; and spontaneous ignition temperature.

**Flash point** is the lowest temperature at which there is sufficient vaporisation of the substance to produce a vapour, which will flash momentarily on the application of a test flame.

**Fire point** is the lowest temperature at which the heat from the combustion of a burning vapour is capable of producing sufficient vapour to enable combustion to continue. Once this temperature is reached then combustion will accelerate and the fire will rapidly grow in intensity.
The **auto-ignition temperature** can simply be defined as being the lowest temperature at which the substance will ignite spontaneously and will burn without a flame as other ignition source being applied.

Spontaneous combustion can take place in certain organic materials based on carbon, which will react with oxygen. If the fuel is a good thermal insulator, the heat generated cannot dissipate resulting in a rise in temperature, which increases the rate of reaction until the ignition temperature is reached and combustion commences.

### 2.1.3 Fire spread

Having achieved combustion due to all three parts of the fire triangle being present in the correct proportions, the fire will spread. This occurs by one or more of the following mechanisms: radiation, convection, or conduction.

**Radiation** is the transfer of heat from a source across an intervening space without any contact between the bodies. The heat travels outward from the fire in straight lines. When it contacts a body it is absorbed, reflected or transmitted. Absorbed heat raises the temperature of the absorbing body. If this absorption of heat is allowed to continue, then combustion may result, spreading the fire some distance away from its source. It can be prevented by increasing the space of separation, or through the use of a fire resistant barrier.

**Convection** is the transfer of heat through the motion of heated matter, ie through the motion of smoke, air, gases etc produced by the fire. The fire produces gases that are lighter than air, which will rise towards high parts of a building. As these hot gases rise, cool gases and air will fall, so feeding the fire with a convection ‘draught’ cycle and also risking spread of the fire at higher levels. Smoke, gases etc can travel great distances via doors and open hatches/windows and can start fires en route. Convection is the most common way a fire will spread in a building and can be prevented by fire separation and compartmentation.

**Conduction** is the transfer of heat through a solid body. Metal is an excellent conductor and heat transfer by conduction is a real hazard, with fire spread through steel joists and beams, steel doors, shutters and walls. With timely and careful application of a water spray to affected areas, heat transference by conduction can be greatly retarded. A water spray pattern absorbs more heat from the affected metal, because the smaller water droplets present a greater surface area. At the same time, less water is used, so creating less water damage to premises. Insulating building steelwork with, for example, dry linings and spray coatings can prevent conduction.
2.1.4 Suppression methods
Firefighting systems, or suppression systems, work to extinguish or suppress a fire by attacking the triangle of combustion or breaking the subsequent chemical chain reaction. Removing one or more of the legs of the fire triangle or breaking the chain reaction sequence will result in the fire being extinguished. Fires can thus be extinguished in four ways or using a combination of these methods:

**Cooling** is the cheapest and most commonly used method of fire extinguishment. The base of the fire is attacked with water to destroy the ability of the fire to sustain itself. Water is a very effective heat absorber. When properly applied, it absorbs heat from the fuel and, as a result, will cool the burning substance to below its critical fire temperature, so as to reduce the amount of flammable vapours given off to sustain combustion.

The exclusion of oxygen from a fire by **smothering** will bring about its extinction. This can be achieved by the use of inert gases, carbon dioxide, foam or a fire blanket. Care must be taken since the smothering of a fire produces little or no cooling effect, allowing flashover conditions to remain. If the fire is ‘opened up’ too early, the consequent inrush of oxygen may result in flashover occurring.

**Starvation** or removal of fuel from a fire will eventually lead to its extinction. The fire triangle is broken by starving the fire of fuel – for example, by turning off the gas.

A fire can be extinguished by breaking the chemical reaction of combustion, a process termed **chemical interference**. The extinguishing agents used in many modern portable fire extinguishers and fixed installation systems will attack the chemical reaction of combustion directly, breaking it down to extinguish the fire. However, caution must be exercised following the extinction of fire because flashover conditions may remain.

2.2 Classes of fire
BS EN 2 defines five classes of fire according to the material undergoing combustion:

- **Class A**: fires involving solid materials, usually of an organic nature, in which combustion normally takes places with the formation of glowing embers (such as paper, wood and similar materials);
- **Class B**: fires involving liquids (such as petrol, paraffin or alcohol) or liquefiable solids (such as rubber, wax or tallow);
- **Class C**: fires involving gases (such as propane and butane);
- **Class D**: fires involving metals (such as magnesium, titanium and aluminium); and
- **Class F**: fires involving cooking media (vegetable or animal oils and fats) in cooking appliances.

Fires involving electrical equipment are unclassified, since electricity is a source of heat. Although fires may start due to an electrical fault, they will involve materials from other classes, such as paper in a photocopier or fat in a deep fat fryer.

Extinguishers are tested for effectiveness and classified for use against each class of fire. Different types of fire must be attacked with different extinguishing media, and it can be dangerous to use the wrong one. For example, water conducts electricity, so its use on an electrical fire could be fatal. The colour of the extinguisher or coloured zone indicates the contents, and the label states the types of fire for which it is suitable.
Table 2 describes the type of extinguisher appropriate for use against each type of fire and the suppression method utilised.

### Table 2: Suitability of extinguisher type by class of fire

<table>
<thead>
<tr>
<th>Class</th>
<th>Type of fire</th>
<th>Extinguishing method</th>
<th>Type of extinguisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fires involving solid materials, usually of an organic nature. Combustion takes place with the formation of glowing embers (carbonaceous fires)</td>
<td>• Cooling&lt;br&gt;• Cooling and smothering&lt;br&gt;• Smothering and chemical interference</td>
<td>Water&lt;br&gt;Foam&lt;br&gt;Powder (ABC type)&lt;br&gt;Halon 1211 (BCF) *&lt;br&gt;Wet chemical</td>
</tr>
<tr>
<td>B</td>
<td>Fires involving flammable liquids or liquefiable solids</td>
<td>• Smothering&lt;br&gt;• Chemical interference&lt;br&gt;• Smothering and chemical interference</td>
<td>Foam&lt;br&gt;Carbon dioxide&lt;br&gt;Powder (ABC type)&lt;br&gt;Powder (BC type)&lt;br&gt;Halon 1211 (BCF) *</td>
</tr>
<tr>
<td>C</td>
<td>Fires involving flammable gases</td>
<td>• Starvation: turn supply of gas off&lt;br&gt;• Chemical interference (only to be done if gas supply can be stopped, otherwise leave to burn)</td>
<td>Powder (ABC type)&lt;br&gt;Powder (BC type)</td>
</tr>
<tr>
<td>D</td>
<td>Fires involving flammable metals **</td>
<td>• Smothering</td>
<td>Powder (D type)</td>
</tr>
<tr>
<td>E</td>
<td>Fires involving electrical equipment</td>
<td>• Smothering&lt;br&gt;• Smothering and chemical interference</td>
<td>Carbon dioxide&lt;br&gt;Powder (ABC type)</td>
</tr>
<tr>
<td>F</td>
<td>Fires involving cooking oils and fats</td>
<td>• Smothering and cooling</td>
<td>Wet chemical</td>
</tr>
</tbody>
</table>

* Halon fire extinguishers: Possession of halon is illegal for most users. Under the 1987 Montreal Protocol on substances that deplete the ozone layer, the production of halons identified as ozone-depleting compounds was banned. The ban was implemented and enforced in EC Regulation No. 3093/94, which prohibits the production of halons, and controls their supply and use. The use of Halon 1211 and 1301 is restricted to the ‘critical users’ listed by Annex VI1 to EC Regulation No. 3093/94. This was implemented in the UK by the Environmental Protection (Controls on Ozone-Depleting Substances) Regulations 2002 and 2003. The regulations required systems and extinguishers to be ‘decommissioned’ and halons ‘recovered’. Authorised disposal agents with the facilities and expertise are able to recover or destroy the halon.

** Special fire extinguishers: Fires involving flammable metals – for example, magnesium or titanium (D type) – should not be tackled with any extinguishers unless specialist training has been provided and only then use special D type extinguishers. Failure to follow this guidance may cause the fire to spread and/or cause serious injury to persons.
As previously mentioned, BS EN 3 defines a fire extinguisher as an ‘appliance containing an extinguishing medium which can be expelled by the action of internal pressure and be directed on to a fire’. Extinguishers, therefore, must provide a means for containing the extinguishant, as well as expelling it when required. This chapter considers the components that come together to form an extinguisher and how these interact to enable it to perform as required.

3.1 Extinguisher design
BS EN 3-7 describes the components of an extinguisher as:
- body: the shell without accessories;
- body fittings: fixed or screwed onto the body, including:
  - control devices;
  - hose assembly and/or horns and/or nozzles;
  - head assembly;
- operating device; and
- extinguishing media.
Fire extinguishers employ two forms of operation:

- **stored pressure**: the extinguisher is kept pressurised at all times. Actuation of the extinguisher opens a valve, making the discharge pipe available for the extinguishing medium to pass through. This system is similar to the principle of an aerosol spray, and the pressurising gas is dry air or nitrogen (Note: carbon dioxide extinguishers are a special case, as they are a stored-pressure type but do not have a pressurising gas or a gas cartridge. Halon 1211 extinguishers, which may be used only by ‘critical users’, are partly self-pressurised, with nitrogen used to top up existing pressure); and

- **gas cartridge**: the extinguisher contains a small CO₂ gas cartridge fitted inside the cylinder. Upon actuation, the cartridge seal is broken releasing the gas, which then pressurises the extinguisher forcing the extinguishing medium out through the discharge nozzle.

### 3.1.1 Stored pressure

In stored pressure units, the body is under a constant pressure, which can be checked by means of a pressure gauge incorporated into the valve or body. The extinguishing medium is expelled from the fire extinguisher by operating the valve.

All stored pressure extinguishers operate in a similar manner. On operation of the extinguisher, the pressure stored within the top of the extinguisher (dry air or nitrogen) forces down on the extinguishing agent, forcing the agent up the syphon tube, through the headcap and hose, and onto the fire. All extinguishers are fitted with a squeeze grip control. This is normally located on the top of the extinguisher, though some may have it as a part of the hose. The control enables discharge to be halted or restarted as needed.

Foam extinguishers can be fitted with either a foam-making branch or a spray nozzle. Wet chemical extinguishers are fitted with a spray lance.

### 3.1.2 Gas cartridge

In gas cartridge units (water-based and powder), the body is not under pressure until operation. The pressurising medium – carbon dioxide – is contained in a gas cartridge within the body of the extinguisher. Upon operation, the seal of the gas cartridge is pierced, releasing pressure into the body of the extinguisher and expelling the extinguishing medium from the fire extinguisher.

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**Components of a typical gas cartridge extinguisher**

- Safety pin
- Operating lever
- Brass hose connectors
- Discharge head
- Release valve mechanism
- CO₂ cartridge piercer
- CO₂ cartridge
- Rubber hose assembly
- Epoxy coated steel shell
- Syphon tube assembly
- Clip-on plastic skirt
- Nozzle
- Brass hose ferrules
EXTINGUISHER CONSTRUCTION

Bodies of gas cartridges are made of the following materials:
- steel;
- aluminium; or
- aluminium alloy.

Cartridges used in most large powder extinguishers may have an internal dip tube to accelerate the carbon dioxide discharge. They are identified by the content’s weight (for example, 55g CO₂). Cartridges are also marked with empty and full weights, together with year of manufacture. Cartridges fitted to water-based extinguishers are plastic-coated for greater protection, while those fitted to powder extinguishers are usually painted only.

There are two types of gas cartridge:
- **piercing disc**: a cartridge with a diaphragm which is pierced by a suitably shaped spindle; and
- **frangible pip**: a cartridge with a frangible pip which is broken by a blunt spindle. The most common is the piercing disc type.

Cartridges are required to comply with BS EN 3 and, if recharged, shall bear the date of recharging. The original manufacturing date should not be obscured. Cartridges should not be recharged if more than ten years have elapsed since the most recent periodic hydraulic test. Hydraulic test dates are stamped onto the body or neck of the cartridge. During a service (see Chapter 6), the weight of the cartridge should be checked against the full weight. If a loss of more than 10% of the content weight is noted the cartridge should be withdrawn from service. Corroded cartridges should be replaced because of the high pressure involved and the potential danger resulting from this. BS 5306-3 now recommends that cartridges should be removed from service if more than ten years have elapsed since the date of manufacture. This is because it is no longer cost effective to hydraulically test them.

If a company is BAFE registered, a corroded cartridge could be recorded as a discrepancy by a BSI inspector during an audit. BAFE certification states that the manufacturer is claiming that the product is certified by BSI as complying with the appropriate standard. This claim can be checked by reference to the appropriate BAFE list. (See section 1.5.)

During a service, cartridges should be checked for the following markings: manufacturer’s name/logo; type and weight of propellant; empty weight; full weight; year of manufacture; and standard of manufacture.
3.2 Extinguisher ratings

Extinguishers are marked or rated with a letter to indicate the class (or designation) of fire on which they can be used. The designations are always accompanied by a number, which indicates the size of the test fire that the extinguisher is capable of extinguishing under test conditions. For classes A, B and F, the larger the number, the larger the test fire they can extinguish under test conditions.

For example, an extinguisher marked 13A is capable of extinguishing a Class A test fire of size 13A. Similarly, an extinguisher marked 144B is capable of extinguishing a Class B test fire of 144B; and an extinguisher marked 75F is capable of extinguishing a Class F test fire of size 75F.

Some extinguishers have a dual rating which indicates that the extinguisher is capable of extinguishing a test fire to the size and type shown. For example, a 13A/113B rating indicates that the extinguisher is capable of extinguishing a Class A fire to the size 13A and a Class B fire to the size 113B, under test conditions.

A series of test fires for each class of fire are defined in BS EN 3, and used in BS 5306-8 to define the extinguisher rating system. The Class A test fire involves a specially measured crib fire of standard cross-section 0.5m wide x 0.56m high but of varying length.

The lengths of the standard test fires and corresponding ratings are defined in Annex I to BS EN 3. For example, a crib which measures 1.3m long indicates that the rating for that extinguisher is 13A. For a crib 2.1m long, the fire rating would be 21A.

Class B ratings denote the largest flammable liquid fire that can be extinguished under test conditions. Different size extinguishers have different ratings and these ratings are shown on the front of the extinguisher.

For fires involving flammable gases and metals (Class C and D fires), there are no established fire ratings. Both Class C and D fires are classed as ‘special risks’ and require specialist training in the use of the extinguishers. Fires involving flammable gases may be extinguished using either ABC or BC powder extinguishers, but should be extinguished only by closing the valve so shutting off the gas supply – if it is safe to do so.

Metal fires require special Class D powder extinguishers fitted with a lance type applicator which applies the special powder gently over the burning metal so smothering the fire. No other types of extinguishers are suitable for this fire risk and should not be used. If other types are used, they will spread the fire causing damage and possible injury to the operator.

For both Class C and D fire risk, always seek professional specialist advice.
There are five main types of extinguishing medium; water, foam, powder, carbon dioxide and wet chemical. Each is suitable for use on different types of fire and has various benefits and limitations. This chapter describes the construction, use and limitations of each type to help the user identify and specify the most suitable extinguisher for their premises.

4.1 Water

The effectiveness of an extinguishing agent on fires of ordinary solid combustible materials – such as wood, paper, textiles and fabrics (Class A risks) – depends principally upon its cooling action. Water has better cooling properties than other agents and is best for use on fires involving those materials that may re-ignite if not adequately cooled. Also, water can penetrate readily to reach a deep-seated fire. Wetting agents in the extinguishant may enhance this ability.

Water conducts electricity and must not be used on live electrical equipment. However, in workplaces containing limited quantities of electrical equipment – for example, where there are lights, wiring and a few small motors only – it is not always necessary to provide special extinguishers to supplement the protection given by water extinguishers. If electrical equipment is present and only a water extinguisher
is provided, it should have passed the electrical conductivity test in BS EN 3, and will be marked as ‘Passed 35kV conductivity test’; the exact words vary. Although these extinguishers provide an element of protection to the operator, a separate line of conductivity may provide an electrical shock risk. A water extinguisher that has not been successfully tested will be marked: ‘WARNING Do not use on live electrical equipment’. Where desktop electronic equipment, such as computers and visual display units are used, a carbon dioxide extinguisher, as well as a water extinguisher is recommended. Employees must be taught to isolate equipment before using a water extinguisher, whenever this can be done safely.

Ethylene glycol (low-freeze additive) can be added to allow an extinguisher to work at lower temperatures. In some manufacturers’ extinguishers this can cause corrosion over prolonged periods of time. They may require re-filling every year to ensure adequate protection. Any advice on the extinguisher or the additive container should be followed.

Construction
Water extinguishers are available in stored pressure and gas cartridge forms, with stored pressure being the most common. The usual size for a water extinguisher is 9 litres but they are available in easy-to-handle 6- and 3-litre formats.

The easy-to-handle extinguishers contain special additives which reduce the water’s surface tension. These types of extinguishers give more firefighting capability per size than conventional water extinguishers. They discharge the firefighting agent in a spray pattern. They are not recommended for use on electrical risks, although they may have passed the 35kV conductivity of discharge test.

The 9-litre capacity extinguishers discharge their firefighting media in a jet. This provides the operator with the ability to fight fires from a safer distance, but it is not safe to use on electrical risks.

Advantages
The advantages of water are as follows:
• good absorbance of heat;
• cost effective;
• readily available;
• long range of jet; and
• good striking power of jet.

Limitations
Water is the most common extinguishing medium. There are limitations in its use as it is only suitable for Class A materials. However, Class A materials are by far the most common fuel source, hence the popularity of the medium.

Water conducts electricity and is not suitable for electrical fires, nor should it be used on flammable liquids (as it may splash and spread the fire), flammable gases (as it may put out a fire, only for it to re-ignite explosively), and flammable metals and cooking oil fires (as it reacts violently, making the fire worse).
4.2 Foam

Foam extinguishers are suitable for use on small fires involving flammable liquids and liquefiable solids, such as paints, oil or fats (Class B) especially where these are in a container or a spillage or when overheated – for example, paint pots. For deep-fat frying ranges, wet chemical extinguishers (Class F) should be used instead. Foam extinguishers may also be used in kitchens and oil-fired boilers, where there is a sill in the compartment to contain any oil leaks. It should also be noted that foam extinguishers are equally suitable for use on Class A fires.

Foam should be applied gently onto the surface of a contained burning liquid fire. This creates a barrier between the burning liquid and air and stops the release of flammable vapours. Foams used in extinguishers produce low expansion foam, for example, AFFF. There are five main types of foam extinguisher, each developed to tackle specific classes of fire. All use aqueous solutions from which the foam is generated. The six types are:

- **aqueous film-forming foams (AFFF):** these foams contain fluorine surfactant chemicals, which produce a foam that acts initially as a blanket, but when the foam breaks down the liquid drain-off forms a film on the flammable liquid surface. This reduces the chance of re-ignition and improves cooling compared with other types of foam. AFFF is ideal for use on shallow spill fires. Most modern portable foam extinguishers use AFFF since it offers superior performance and is good for general fire protection;
- **protein foams (P):** now rarely used in portable extinguishers, these use hydrolysed proteins as the foaming agent and act by forming a slow-spreading blanket of foam on the burning liquid surface;
- **fluoroprotein foams (FP):** these behave in the same way as protein foams but the fluorine containing part of the compound gives greater foam stability and flame quenching properties, so they are useful on hydrocarbon fires;
- **film-forming fluoroprotein foams (FFFP):** as the name suggests, these operate by forming a film to seal the surface of the liquid. They are similar to AFFF, but have better burn-back resistance; and
- **alcohol-resistant foam (AR):** this is a special risk, foam for use on water-miscible solvent fires, such as cellulose and spirits. In view of the specialist nature of dealing with these risks, it is recommended the you consult with the extinguisher manufacturer or service provider to ensure that this product is the correct type to protect your risk.
- **eco-foam:** as with other firefighting foams, this media provides Class A and B firefighting performance with biodegradability qualities to minimise the harm to the environment. Currently, no standard exists, however the Department for Foods and Rural Affairs (Defra) has published guidelines on the environmental characteristics for these products and services. The products currently available are likely to comply with Dutch standards; contact manufacturers for details.
Ethylene glycol (low-freeze additive) can be added to allow extinguishers to work at lower temperatures. In some manufacturers’ extinguishers, this can cause corrosion over prolonged periods of time. They may need to be re-filled every year to ensure adequate protection. Any advice on the extinguisher or the additive container must be followed.

**Construction**

Foam extinguishers are available in stored pressure or gas cartridge forms, with stored pressure being the most common. On operation of this extinguisher, the pressure stored in the ullage space presses on the foam solution forcing it up the syphon tube, through the headcap and hose.

On operation of a gas-cartridge foam extinguisher, the gas released when the cartridge is pierced forces the foam solution, up the syphon tube, through the headcap and hose. In pre-mix designs, the foam concentrate is already mixed with the water before the extinguisher is activated; whereas in post-mix the foam or water additive concentrate (held in a sealed container at the bottom of the gassing tube) is only introduced into the water at the time of activation.

As is the case for some water extinguishers, most foam extinguishers deliver the foam as a spray rather than a continuous jet. Some foam extinguishers may be fitted with a foam branchpipe which aspirates the foam. The most common sizes are 6- and 9-litre capacity units, which are for industrial/commercial applications. Two- and 3-litre models are available for the smaller risks.

**Advantages**
The advantages of foam are as follows:
- non-toxic;
- suitable for multi risks (Classes A and B);
- is effective against obstructed Class B fires;
- prevents re-ignition of flammable liquids;
- extinguishes fire progressively; and
- does not impair visibility.

**Limitations**
Foam is ineffective against running fires since it is difficult to maintain the foam blanket. Hence, caution should be observed when using foam on free-flowing flammable liquid fires.

Some water-miscible liquids, such as alcohols, will rapidly break down the foam, impairing the extinguishing action. If the fire risk assessment of the workplace indicates that this type of hazard exists, special alcohol-resistant foam extinguishers should be considered. Alcohol-resistant foam (AR) contains a polymerising agent that stabilises the foam against alcohol’s solubility in water, forming a gelatinous seal. Powder extinguishers may offer an alternative and suitable firefighting media.

Foam is not suitable to use on live electrical equipment, since it can cause a short circuit. Furthermore, if a short circuit does not occur, the operator may be left standing in a residual pool of water-based foam, which could conduct electricity. Spray foams with 35kV BS EN 3 test approval, however, will provide users with a level of safety if inadvertently used on live electrical equipment.
Foam can also freeze, so use in the cold must be carefully considered. The use of low-freeze additives may be possible, however, it should be noted that the use of these additives will reduce the extinguisher’s performance. Although modern foam mediums tend to be compatible with most powders, users must ensure that, where a powder has been used, the foam is compatible. Foam should not be discharged to groundwater (see section 6.3.4 on disposal of medium).

4.3 Powder
These are useful multi-purpose extinguishers which are suitable for dealing with fires in electrical equipment and flammable liquids, as well as Class A risks, such as wood, solids and paper. However, powder may not readily penetrate the spaces inside electrical equipment and, since it does not have the cooling properties of water, re-ignition is common. The use of a powder also results in the medium being spread widely and, even after a small fire, a considerable period may be necessary to clear it up, particularly where it gets inside machinery.

Powder is generally the most suitable extinguishant for fires involving flammable liquids. Powder acts more rapidly than foam and is particularly suitable for dealing with fires which may spread to surrounding materials before a complete foam blanket can form over the burning liquid.

It should be noted, however, that if both extinguishing agents are to be used in firefighting operations, the powder should be used first and the area then sealed with foam after the flames have been extinguished. This is because powder acts faster, then foam cools and discourages re-ignition. It is also vital that the powder and foam are compatible.

Powder extinguishers deal more effectively with larger areas of burning liquid than other extinguishers of comparable size. They are effective too on fires in free-flowing liquids, especially where the liquid spills over a fairly large area.

Class B and C fires are extinguished by reactivity of powder within the flame. Fire is a chain reaction whereby free radicals are generated. When finely divided particles of BC powders are introduced into the flame, the recombination of radicals is inhibited and the chain reaction is interrupted. Providing sufficient powder is available, the combustible air/vapour fuel mixture is diluted and available heat dissipated. Subsequently, the chain reaction is terminated and burning stops.

Class A fires are initially extinguished by a BC-type flame knock down. However, fires of this type frequently contain glowing embers which, if left, tend to re-ignite and regenerate the burning process. Powders containing phosphate/sulphate mixtures have melting points of 150°C to 180°C. In contact with hot
smouldering materials, the powder grains fuse to give a sticky, oxygen impermeable, barrier. The pores in the material (from which flammable gases may be liberated) are blocked by the sticky residues and re-ignition prevented. Therefore Class A fires require ABC powder.

Class D fires are based on burning metals and particularly the alkali metals including sodium, potassium, caesium and lithium. The problem with metal fires, generally, is that they react violently with other firefighting media. Water and any of the foam materials evolve an explosive gas-hydrogen. Carbon dioxide also gives a violent chemical reaction. Conventional powder extinguishers are of little use on metal fires because the velocity of application scatters the burning material – both BC and ABC type powders react with the burning metal. Only Class D powders should be used on this type of fire.

Application of Class D powders is most effectively achieved by a gently pouring action to prevent scattering of the burning material. This may be from an extinguisher fitted with a special lance or, in the case of small isolated risks, shovel application may be appropriate. In this way, complete coverage of the burning material is possible without spreading the hazard. The high temperatures inherent in fires of this nature are sufficient to stimulate formulation of a semi-fluid crust, which binds together the powder particles. Air is excluded by the rugged crust and the fire is extinguished. Rapid dissipation of excess heat through the crust assists in cooling, thereby increasing the resistance to re-ignition.

Thus, there are four types of powder extinguisher:

- **ABC powders**: these are commonly referred to as general purpose, multi-purpose, or all purpose powders. They are also very effective against running fuel fires. The powder is a mono-ammonium phosphate, treated with flow and moisture repellent additives. ABC powders are suitable for use in stored pressure or gas cartridge type extinguishers. They are non-toxic, and mass for mass offer the most effective firefighting medium.

- **BC powders**: these are commonly referred to as standard powder. They contain sodium or potassium bicarbonate treated with flow and moisture repellent additives. They offer fast knock down and can be used in environments over a wide temperature range of -20°C to 60 °C (EN 3 models). As the name suggests, these powders are recommended for use on Class B and C fires. They are particularly effective against fire involving alcohols, ketones and esters.

- **D powders**: these are suitable for fires involving metals. Once the type of metal has been established, specialist advice should be sought to identify the most suitable type of powder to be used. Generally speaking for metal fires not involving lithium, a sodium chloride-based powder is appropriate, for example, Croda M28 F; and for metal fires involving lithium, graphite-based powder is more suitable, for example, Chubb L2, Ansul Lith-X. Powder should be applied gently to the burning metal through a low velocity applicator. This is to allow a thick blanket to be built up over the burning metal with the minimum of disturbance.

- **high performance powders**: these are for special applications. An example is Monnex (potassium bicarbonate urea base), which is a type of BC powder. It is recommended for large Class B and C fires and is effective against fires containing alcohols, ketones and esters.
In view of the need to be specific in the choice of agent in relation to the fire risk, advice should be sought from manufacturers of extinguishers. They are in a position to advise which extinguishing media and specialist extinguisher to select for a given situation.

**Construction**

Powder extinguishers are available in sizes up to 12kg capacity (maximum under BS EN 3) and in wheeled trolley versions carrying up to 150kg (maximum in BS EN 1866: Mobile fire extinguishers. Characteristics, performance and test methods).

**Advantages**

The advantages of powder are as follows:

- suitable for Class A, B and C fires;
- specialist powders are available for Class D fires;
- safe to use on electrical equipment;
- fast flame knock-down;
- non-toxic;
- effective against running fuel fires; and
- mass-for-mass, the most efficient firefighting medium.

**Limitations**

It is important that the mixing or cross-contamination of different powders be avoided. Some mixtures react, sometimes after a long delay, producing water and carbon dioxide with consequent caking of the powder. In closed containers, this can result in a pressure rise, which could cause the extinguisher to explode.

The disadvantages of powder extinguishers are that they are messy and can contaminate over a wide area. For instance they may contaminate food or expensive equipment. They may reduce visibility when discharged in confined areas, which could jeopardize rescue and escape. They do not prevent re-ignition of flammable liquids and are ineffective against obstructed Class B fires. They cannot partially extinguish Class B fires. Powders can also be corrosive. Only compatible powders can be used with foams.

**4.4 Carbon dioxide**

Carbon dioxide (CO₂) extinguishers are suitable for use on small fires involving flammable liquids and electrical equipment, particularly where it is necessary to avoid damage or contamination by foam or powder deposits.

Carbon dioxide is an inert gas (that is, it does not take part in a chemical reaction). It simply extinguishes the fire by displacement of oxygen by its bulk. Because it is a gas, it can reach fires in otherwise inaccessible locations.

**Construction**

Carbon dioxide extinguishers are pressure vessels and strict legal requirements cover their manufacture and use. Bodies are manufactured to BS 5045 and must incorporate a bursting disc or bursting valve. The disc is so designed that in the event of increased pressure from either overfilling or a temperature rise, it will safely vent the contents to the atmosphere. Carbon dioxide gas is stored in liquid form in the body. CO₂ remains liquid at 51 bar at 15°C. The ratio of expansion is approximately 450:1. In general terms, 1kg of CO₂ in liquid state will produce about 0.5m³ of free gas.
Expansion of the gas may take place in the hose if fitted, but the major expansion takes place in the discharge horn. The main purpose of the design is to stop the entrainment of air by reducing the velocity. Without this, CO₂ acts like a blow torch and would increase the intensity of the fire. Generally, CO₂ extinguishers have few components that require replacement on a regular basis, however, the discharge horn may become damaged from knocks resulting in cracks or splits and should be replaced if this occurs.

On operation of the extinguisher, a valve is opened and liquid carbon dioxide within the cylinder is forced up the syphon tube through either a swivel horn or a hose and horn, and discharged as a gas onto the fire. The discharge tube allows liquid CO₂ to be released from the base of the extinguisher instead of the gas pressure from the upper part of the extinguisher. Portable models are available in sizes up to 5kg capacity but these can be heavy to handle.

Advantages
The advantages of carbon dioxide are that it:
- does not conduct electricity;
- is clean;
- is quick to operate; and
- searches for the fire.

Limitations
Carbon dioxide is an asphyxiant and has freezing capabilities. These means it is not user friendly. Care should be taken when using the extinguishers in basements or enclosed spaces as the gas can be an asphyxiant. The extinguishers are also noisy on operation. Carbon dioxide is unsuitable for extinguishing fires outdoors since the gas disperses on release.
4.5 Wet chemical

Wet chemical is a specialist extinguisher medium designed for use on fires involving cooking fats and oils (vegetable or animal), for example in chip pans and deep fat fryers. Due to the specialist application of this firefighting medium, it has its own fire classification – Class F – although it is also able to extinguish Class A and, in some cases, Class B fires.

The wet chemical extinguishing medium generally includes aqueous solutions of potassium acetate, potassium carbonate, potassium citrate or combinations of these materials. Ethylene glycol (low-freeze additive) can be added to allow an extinguisher to work at lower temperatures, but this can cause corrosion over prolonged periods of time. Extinguishers containing ethylene glycol must also be re-filled every year to ensure adequate protection.

Class F fires are extinguished by gentle application of the extinguishing medium. This requires an extinguisher with a lance type applicator providing an element of operator protection. When the firefighting medium is applied to the hot oil, it reacts to form a soap-like substance which provides a blanket between the burning oil and oxygen, so restricting the release of flammable vapours. The manufacturers of these products recommend that the total contents are discharged to maximise the cooling effect.

Construction

The design of the extinguishers incorporates a short lance to enable the foam to be discharged into the fryer from a safe distance.

Typical sizes are 6- and 9-litre capacity units, though BS EN 3 also permits 2- and 3-litre capacity units.

Advantages

The advantages of wet chemical are as follows:
- multi risk, suitable for use on Class A, B and F fires (depending on rating);
- prevents re-ignition of flammable liquids;
- extinguishes fires progressively;
- cools;
- does not impair visibility; and
- meets requirements of BS EN 3 electrical test, providing users with a level of safety if inadvertently used on live electrical equipment.

Limitations

Wet chemical extinguishers are not electrical safe. They are not suitable for use on flammable gases or metals. The medium is also susceptible to freezing at low temperatures but, if sited in a commercial kitchen, freezing should not be a problem.
4.6 Halon
Under the terms of the Montreal Protocol, implemented by European Commission (EC) Regulation 2037/2000, the use of chlorofluorocarbons (CFCs), including Halon 1211 in fire extinguishers and 1301 in fire suppressant systems, was banned from 31 December 2002, other than for critical users, defined in its Annex VII of the Regulation. The Regulation banned the re-filling of existing systems, but allowed users until the end of December 2003 to decommission their systems.

Critical uses of Halon 1211 are:
- in hand-held fire extinguishers and fixed extinguisher equipment for engines for use on board aircraft;
- in aircraft for the protection of crew compartments, engine nacelles, cargo bays and dry bays;
- in fire extinguishers essential to personal safety used for initial extinguishing by fire brigades; and
- in military and police fire extinguishers for use on persons.

From December 2002 it was an offence to supply halon, and from December 2003 it became an offence to possess halon extinguishers, except for the critical uses defined above.

In the UK, a limited number of approved service centres are able to offer decommissioning and maintenance services. The Fire Industry Association provides training for personnel authorised to maintain halon in critical uses and who can dispose of halon extinguishers.
The number of extinguishers needed in a particular building is calculated according to their classification. For Class A fires, this is given as the total floor area per floor (in m²) x 0.065. This results in an allocation of one 13A rated extinguisher for general (Class A) protection to cover 200m².

In addition, the minimum rating for a workplace should be 26A per floor – that is, two Class A extinguishers – except on an upper floor of less than 100m² in a building in single occupancy, where the rating may be 13A. A 9-litre water or foam extinguisher can achieve a 13A rating and, often, another general Class A extinguisher, like powder, can also be used if the hazards present suggest this would be appropriate. Mixing and matching is, therefore, possible to achieve the desired rating and protection.

Table 3 indicates the suitability of each extinguisher type for use on each type of fire and provides typical ratings for extinguishers by size.
Table 3: Typical extinguisher sizes and ratings

<table>
<thead>
<tr>
<th>Extinguisher type</th>
<th>Risk</th>
<th>Typical extinguisher sizes and ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Class A hazards: solids, wood, paper, cloth. For general protection of ordinary combustible materials</td>
<td>9l 13A, 6l 8A, 6l with additive 21A, 3l with additive 13A</td>
</tr>
<tr>
<td>Foam</td>
<td>Class B hazards: liquids, fats, paints and oil. Some foam extinguishers, such as AFFF, are also suitable for combustible solids fires (Class A)</td>
<td>9l 21A: 183B, 6l 13A: 144B, 2l 5A: 55B</td>
</tr>
<tr>
<td>Powder (multi-purpose)</td>
<td>Class A hazards: solids, wood, paper, cloth Class B hazards: liquids, fats, paint, oil and electrical equipment</td>
<td>9kg 43A: 233B, 6kg 34A: 233B, 3kg 21A: 89B</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Class B hazards: liquids, fats, paint, oil and electrical equipment</td>
<td>5kg 70B, 2kg 34B</td>
</tr>
<tr>
<td>Wet chemical</td>
<td>Class F hazards: cooking oil fires. Also suitable for combustible solid fires (Class A)</td>
<td>6l 75F, 6l 13A</td>
</tr>
</tbody>
</table>

With flammable liquids, the maximum areas for which Class B extinguishers are suitable are shown in Table 4 (see section 5.3).

Carbon dioxide and powder extinguishers can be used on live electrical equipment, but whenever possible the apparatus should be isolated from the live circuit or the current turned off before the fire is tackled. It should always be turned off as soon as possible after firefighting to prevent re-ignition and await examination by a competent person to decide if it is safe to reactivate.

Examples of hazards for which carbon dioxide extinguishers are especially suitable include computers and delicate laboratory equipment, but they are of limited use in the open air. Care should be taken regarding the use of carbon dioxide extinguishers in basements or enclosed spaces owing to the asphyxiate nature of the gas.

The cooling properties of powder and carbon dioxide are limited. The gaseous agent gives no real protection against re-ignition, which may occur once the gas disperses. It is not as effective as foam on liquid fires in containers where the liquid is hot because it has been burning for some time or it has been heated in a process.

No attempt should be made to put out the flame from a fire involving an escaping gas (Class C fire) using an extinguisher because an explosion may result if unburnt gas escapes and then re-ignites. It is, therefore, necessary with fires involving gases to allow the gas to burn safely, while ensuring that the flames do not spread to nearby combustible materials, until the gas supply can be isolated at a marked and accessible gas valve.
5.1 How many?
The basic scale given below is applicable to a wide range of fire risks/premises but
additional extinguishers should be provided at locations where the likelihood of fire is
above average, or where a fire would be particularly intense.

5.2 Class A risks: 0.065 calculations
For Class A risks:
- there should be at least two extinguishers sited on each storey;
- the total Class A rating for all extinguishers on that storey should not be less than:
  \(0.065 \times \text{floor area (m}^2\) and in no case less than 26A; and
- a 13A rated extinguisher covers 200m².

5.2.1 Single occupancy
The above applies except in single occupancy buildings where the topmost floor is
less than 100m². Here, a single extinguisher on the top floor only may be admissible;
two extinguishers will still be required on lower levels.

5.2.2 Multiple occupancy
As each storey could be occupied by separate companies, the minimum provision of
26A applies. The above provision is based on minimal risk in a building. Provision of
fire equipment should be increased depending on fire load of the building. Additional
reference should be made to: BS 5306-8, Section 6.2.

5.2.3 Worked example
In a building, the floor dimensions are: 30m x 20m = 600m² (floor area)

The minimum Class A rating for all extinguishers on that storey should not be less than:

\[600m^2 \times 0.065 = 39A\]

Therefore, the following options are available:
- 2 x 21A rated extinguishers;
- 3 x 13A rated extinguishers; or
- 5 x 8A rated extinguishers.

5.3 Class B risks
The following factors should be taken into account when providing extinguishers for
Class B risks in a building:
- each room or enclosure should be considered separately;
- risks more than 20m apart should be considered separately;
- containers sited within 20m of another container should be assessed either as
  undivided groups or as divided groups:
  - in undivided groups – containers should be less than 2m apart;
  - in divided groups – two or more containers should be more than 2m but less
    than 20m apart; and
- spillage – should be calculated from the anticipated volume of spillage –
  recommended minimum rating 10 x volume (in litres) of spillage. Fires involving
  spilled flammable liquids are variable quantities and it is difficult to predict their
  severity. Under normal circumstances, spillages may be expected to spread to any
  depth up to a minimum of 1mm.
To determine the fire protection required for a contained Class B risk, the surface area of the container and the separation distance from other contained Class B risks should be considered. Where two containers are more than 20m apart, each risk must be considered separately, as defined in BS 5306-8.

Table 4 (adapted from BS 5306-8) defines the maximum area of Class B fire (deep liquid) for which extinguishers are suitable. This table can be used to look up the nearest value to the surface area of the contained B risk; and by reading across the number and minimum fire rating of extinguishers needed to deal with a risk of that surface area can be found.

For example, if the contained B risk is 1.5m², this can be dealt with by:
- 3 x 89B foam extinguishers (1.78m²);
- 2 x 144B powder or foam extinguishers (but not a combination) (1.8m²); or
- 1 x 233B powder or foam extinguisher (1.55m²).

For foam extinguishers, the maximum manufactured size rating is 183B, which means the maximum area for one foam extinguisher is 1.22m².

**Table 4: Maximum area of Class B fire (deep liquid) for which extinguishers are suitable (adapted from BS 5306-8)**

<table>
<thead>
<tr>
<th>Extinguisher rating</th>
<th>Maximum area for three extinguishers* (foam only) m²</th>
<th>Maximum area for two extinguishers** m²</th>
<th>Maximum area for one extinguisher*** m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>13B</td>
<td>0.26</td>
<td>0.16</td>
<td>0.09</td>
</tr>
<tr>
<td>21B</td>
<td>0.42</td>
<td>0.26</td>
<td>0.14</td>
</tr>
<tr>
<td>34B</td>
<td>0.68</td>
<td>0.42</td>
<td>0.23</td>
</tr>
<tr>
<td>55B</td>
<td>1.10</td>
<td>0.69</td>
<td>0.37</td>
</tr>
<tr>
<td>70B</td>
<td>1.40</td>
<td>0.88</td>
<td>0.47</td>
</tr>
<tr>
<td>89B</td>
<td>1.78</td>
<td>1.11</td>
<td>0.59</td>
</tr>
<tr>
<td>113B</td>
<td>2.26</td>
<td>1.41</td>
<td>0.75</td>
</tr>
<tr>
<td>144B</td>
<td>2.88</td>
<td>1.80</td>
<td>0.96</td>
</tr>
</tbody>
</table>

* If three extinguishers are used they must all be foam.
** If two extinguishers are used they must either be both foam or both powder. A foam and powder combination is not permitted.
*** If a single extinguisher is used it may be either powder or foam.

Additional reference should be made to BS 5306-8, Section 6.3.
5.4 Siting requirements

It is normal practice to locate extinguishers in conspicuous locations, either on wall brackets or on stands, ensuring that they can be easily seen and ready for immediate use. The normal position for the siting of extinguishers is near to exits or on escape routes, such as in corridors, stairways, landings, and lobbies. It is sometimes convenient to locate them below manual fire alarm call-points. If it is impractical to place extinguishers in conspicuous places, then signs should be used to draw attention to them. Extinguishers not stand-mounted but up to and including those weighing 4kg should be wall-mounted with the handle about 1.5m from the floor. Heavier extinguishers should be mounted with their handles about 1m above the floor.

The operator of the extinguisher should not have to travel more than 30m from the fire in order to get an extinguisher. They should always be accessible and nothing should be placed in front of them, even temporarily. If an extinguisher is specified for a special fire risk then the extinguisher should be sited in close proximity to that risk, but not so close that a fire will render it inaccessible and useless.

Usually, extinguishers are grouped and positioned with other safety equipment, fire warning call-points, hose reels and instruction notices to form a fire point. Consistency in the location of fire points will help employees gain familiarity in where equipment and safety instruction may be found. Finding a suitable place for a fire point that is accessible, obvious, and does not obstruct routes, is worthy of some effort if portable firefighting equipment is to be used without hesitation. Designing a suitable recess in new buildings should be part of the safety considerations. These should be about 30m apart.

Extinguishers sited in hazardous environments, such as corrosive environments, should be housed in containers to protect them from damage. Similarly, extinguishers placed in the open must be protected against extremes of temperature and inclement weather. In the latter case, the supplier or service engineer may add quantities of antifreeze to the contents. The temperature range of the extinguisher should be noted and the extinguisher should be sited in such a way that it should stay within...
its temperature limits. If an extinguisher is located in an area where there may be vandalism, consideration of using a local tamper alarm may be an effective solution.

In summary, the following factors should be considered when siting fire extinguishers. They should be:

- on escape routes;
- on stands;
- elevated to a height so that the carry handle is 1.5m from the floor for extinguishers up to 4kg and 1m for larger extinguishers;
- adjacent to the risk;
- near a door, inside or outside according to occupancy;
- at the same position on each storey, in multi-storey buildings;
- in groups forming ‘fire points’;
- in shallow recesses, where possible;
- away from extremes of temperature within extinguisher temperature ranges, corrosive environment and/or vandalism; and
- a maximum of 30m travel distance from any point in a building.

In addition, the following should be considered when siting fire extinguishers as initial provision or as additions to existing fire protection equipment in a building:

- method of operation: all extinguishers, where possible should operate by the same method;
- ease of handling: the occupiers should be capable of handling the types and sizes recommended;
- labelling: where different types of extinguishers are sited together they must be properly labelled to prevent the wrong extinguisher being used;
- suitability for risk: extinguishers with suitable jet or spray nozzle or flexible hoses to suit the risk involved;
- maintenance arrangements: extinguishers to be serviced to the latest standard; and
- rating: the fire rating requirement must be covered.
Commissioning and servicing of fire extinguishers should only be carried out by a competent person. This is someone who has been trained in the procedures involved and passed an appropriate examination. A competent person must also be able to demonstrate practical experience and suitable ongoing professional development through refresher training every three years. He must also have access to the required tools and equipment as well as manuals and information relating to any special procedures that are recommended by extinguisher manufacturers.

The responsible person in any premises must ensure that any person appointed to service fire extinguishers has received such training and has passed the appropriate examination. There are two independent examination bodies currently recognised by British Approvals for Fire Equipment (BAFE): the British Fire Consortium (BFC) and the Independent Fire Engineering and Distributors Association (IFEDA). In addition, a number of organisations, including the Fire Protection Association (FPA) and the Fire Industry Association (FIA), offer training courses leading to BAFE examinations.

In addition to regular servicing by a competent person, the responsible person should conduct simple visual inspections at least once a month.
6.1 Practical considerations

6.1.1 Specifying suitable extinguishers
Conformity to the relevant standards (see chapter 1) can be checked by looking for independent third party certification to these standards, offered, for example, by the British Standards Institution Kitemark and the Loss Prevention Certification Board (LPCB).

Under the European Pressure Equipment Directive, all new fire extinguishers must carry a CE mark signifying that they comply with the Directive. However, the presence of a CE mark does not in any way give an indication of its performance as a fire extinguisher.

Siting and provision of extinguishers is detailed in chapter 5.

6.1.2 Appointing a competent service technician
BS 5306-3 specifies the inspection and maintenance procedures to be carried out on fire extinguishers. It details actions to be undertaken by the user and by the competent person responsible for the maintenance of extinguishers in the premises.

A competent person must have undergone an initial programme of training, including on-the-job experience, and successfully completed an examination administered by an independent examination body. A competent person should be registered under the BAFE scheme for contract maintenance of portable fire extinguishers (incorporating the registered fire extinguisher service technicians scheme), SP101/ST104. A typical training course should include:
1) on the job experience gained under the supervision of a competent person;
2) attendance of a training course;
3) examinations – the trainee must achieve a minimum standard in both theory and practical examinations administered by an independent examination body.

Theoretical training on the initial training course should cover:
- provisions of BS 5306-3, BS 5306-8, BS EN 3-7;
- classes of fire as defined by BS EN 2;
- legal requirements relating to the transportation of extinguishers;
- legal requirements set out in the Pressure Equipment Directive;
- disposal of extinguishing media;
- safe working practices; and
- health and safety issues affecting a service technician.

The practical test should allow the trainee to demonstrate their skills in fault-finding in, and servicing of, a number of extinguishers. To maintain competency, ongoing professional development is considered essential and registered technicians should receive refresher training, and pass a written examination, at three yearly intervals.

Theoretical training on the refresher course is likely to include:
- provisions of the relevant British Standards;
- commissioning services;
- basic and extended services;
- overhauling;
• new classes of fire;
• new products in the market place;
• new requirements;
• practical installation;
• recharging;
• relevant UK statutory regulations including fire legislation.

### 6.1.3 Written reports and documentation

BS 5306-3 requires that the competent person performing maintenance should produce a written report for the responsible person. The report should include:

- a list of any extinguishers that are ‘condemned’, ‘not maintained’ or missing;
- any requirement to permanently replace extinguishers as soon as possible;
- any requirement to provide additional extinguishers as soon as possible to ensure an appropriate level of cover (in accordance with BS 5306-8); and
- a note of the responsible person’s obligation under fire legislation to provide an appropriate level of firefighting equipment at all times.

In addition, the competent person should also provide the responsible person with a certificate of inspection, which should include:

- the name, full address and telephone number of the maintenance company;
- the date of maintenance;
- service technician’s ID;
- a list of all portable extinguishers included in the maintenance programme, including all non-conforming equipment, and recommendations for appropriate corrective action or reference to where this information can be found;
- a statement that, apart from non-conforming extinguishers as recorded, all portable fire extinguishers have been inspected and serviced in accordance with BS 5306-3; and
- signature of responsible person.

The responsible person should sign the certificate after the maintenance work has been completed and before the technician has left the premises. If it is not possible to obtain the responsible person’s signature (for example, on unmanned sites), the reason should be noted.

The following information, as a minimum, should be entered onto a service label for each type of extinguisher after completion of service, along with the full postal address of the servicing company:

- date of service;
- type of service – basic, extended or overhaul;
- engineer’s ID;
- date of last discharge; and
- weight.

It is recommended that companies devise template forms so that three copies are produced: one for the customer, one file copy, and one to remain in the template book.
6.1.4 Halon and non-compliant extinguishers
Halon is no longer permitted as an extinguishing agent, except for ‘critical uses’, as it depletes the ozone layer (see section 5.6). There are special arrangements for the withdrawal of halon extinguishers from service.

In addition, certain extinguishers should be regarded as ‘non-compliant’ because of their type, construction, method of operation, or condition. These extinguishers should not be maintained.

Examples of such extinguishers are:
- soda acid extinguishers;
- extinguishers with a riveted body shell;
- extinguishers with a plastic body shell;
- extinguishers that require inversion to operate;
- non-refillable extinguishers that have reached their expiry date; and
- extinguishers manufactured after 2002 which do not carry a CE mark.
This excludes refurbished extinguishers, which cannot carry the CE mark and cannot be condemned for not carrying it.

All non-compliant extinguishers should be marked ‘CONDEMNED’ together with the reason, and should be noted in the written report (see section 6.1.3). Condemned extinguishers must be replaced. Note: a condemned extinguisher may not be taken away or replaced without consent of the owner.

6.2 Commissioning
BS 5306-3: 2009 introduced a recommendation for fire extinguishers to be commissioned immediately by a competent person. It defines a commissioning sequence that should be undertaken following the removal of any packaging and protection and prior to it being placed in its designated location. Extinguishers should only be installed and positioned upon completion of the commissioning process.

6.3 Servicing schedules
Fire extinguishers are first-aid appliances and must be maintained to ensure their continued performance. BS 5306-3 specifies the inspection and maintenance procedures to be carried out on fire extinguishers. It details actions to be undertaken by the user and by the competent person responsible for the maintenance of extinguishers in the premises. It recommends that maintenance procedures are carried out at least once per year.

6.3.1 User inspections
A regular visual inspection should be conducted by the responsible person. This should be carried out at least once a month. Visual inspections should ensure the following:
- Has it been used?
- Is it located in the designated place?
- Is it unobstructed and visible and its operating instructions facing outwards?
- Are the operating instructions clear and legible?
- Has there been any damage sustained?
- Does it have a reading in the operable range?
- Are the seals or tamper indicators broken or missing?
- A check of the gauge on stored pressure units should be noted.
The responsible person should record the results and arrange for the competent person to take any actions required.

6.3.2 Inspection periods
BS 5306-3 outlines inspection and maintenance procedures that range from basic and extended services to a complete overhaul of an extinguisher. It also identifies the maximum intervals permitted between inspections (see Table 6). These procedures should only be carried out by a competent person, and then only if suitable safety checks have been undertaken.

Before opening any extinguisher, any vent holes or devices should be checked. If vents are blocked, they should be clear before opening. All extinguishers should then be opened slowly to allow for the release of any residual pressure. A periodic discharge test should only be carried out after a check for corrosion has taken place. A corroded extinguisher body could burst, injuring the operator. If the safety pin is missing from an extinguisher, ensure it is in good working order and is full, before fitting a new pin and seal prior to carrying out the service.

6.3.3 Recharging
Further information relating to the recharging of extinguishers is contained within BS 6643-1: Recharging fire extinguishers (manufactured to BS 5423: Specification for portable fire extinguishers). Specification for procedure and material and BS 6643-2: Recharging fire extinguishers (manufactured to BS 5423: Specification for portable fire extinguisher). Specification for powder refill charges. (Note: These instructions also apply to extinguishers manufactured to BS EN 3. BS 6643-1 and 2 are on the British Standards revision programme and some changes may arise as a result of this review.) These deal with the refilling of extinguishers so as to maintain extinguishing performance and safety, and give requirements and performance tests to establish equivalence of refill charges to the original powder.

BS 6643-1 gives details of the refill charges for fire extinguishers, along with specifications for components, gas cartridges and propellants. Essentially, components (such as bursting discs, seals etc) should be as specified by the manufacturer. BS 5306-3 requires that gas cartridges conform to BS EN 3, so while BS EN 3 cartridges may be fitted to older BS 5423-approved extinguishers, the reverse is not true. Propellants must be:
- chemically the same as that used originally;
- chemically the same as that used originally but with a different tracer gas to facilitate leak detection; or
- nitrogen or air, where air was used originally.

All extinguishing medium should be emptied and discarded. (Note: halon is a special case and requires specific actions to be taken.) The following should be followed for refill charges:
- carbon dioxide – refill must comply with BS 6535-1;
- foam – the manufacturer’s specified refill charge;
- water – tap or other potable water (not through an external tap or hose, because of the risk of Legionnaires’ disease), following manufacturer’s specification for any additives; and
- powder – as originally, previously or currently specified by the manufacturer or to comply with BS 6643-2.

After recharging in accordance with the manufacturer’s instructions, the extinguisher should be marked with the following information:
- ‘This extinguisher has been recharged by [name and address] in accordance with BS 6643-1 and the recommendations of BS 5306-3’;
- the recharging date;
- identification of the extinguishing medium if it is different from that originally used and marked on the extinguisher.

### Table 6: Maintenance intervals (adapted from BS 5306-3)

<table>
<thead>
<tr>
<th>Type of extinguisher</th>
<th>Basic service (B), (C), (D), (E)</th>
<th>Extended service (C), (E)</th>
<th>Overhaul (E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water and water based</td>
<td>Every 12 months</td>
<td>Every 5 years</td>
<td>—</td>
</tr>
<tr>
<td>Powder</td>
<td>Every 12 months</td>
<td>Every 5 years</td>
<td>—</td>
</tr>
<tr>
<td>Powder-primary sealed</td>
<td>Every 12 months</td>
<td>Every 10 years(F)</td>
<td>—</td>
</tr>
<tr>
<td>Halon (G)</td>
<td>Every 12 months</td>
<td>—</td>
<td>Every 10 years</td>
</tr>
<tr>
<td>Carbon dioxide (H)</td>
<td>Every 12 months</td>
<td>—</td>
<td>Every 10 years</td>
</tr>
</tbody>
</table>

(A) The intervals in this table disregard any recharging of the extinguisher.
(B) The maintenance intervals given for basic service have for practical purposes a tolerance of ±1 month.
(C) Intervals (other than carbon dioxide extinguishers) should be taken from:
- basic service: the date of commissioning or the last service;
- extended service:
  - water, water-based and powder: five years from the date of commissioning or six years from the date of manufacture of the extinguisher, whichever is sooner, and subsequently every five years from the date of the last extended service;
  - powder-primary sealed: ten years from the date of commissioning or 11 years from the date of manufacture of the extinguisher, whichever is sooner, and subsequently every ten years from the date of the last extended service.
(D) Intervals may be shortened on the recommendation of the competent person where inspection reveals environmental and/or special hazards, or at the request of the responsible person.
(E) Replacement of parts does not affect these intervals. For example, if the hose of a water-based extinguisher is replaced after the extinguisher has been in service for six months from commissioning, then the basic service should be carried out after a further six months.
(F) Primary sealed stored pressure extinguishers should be returned to the manufacturer/supplier for recharging.
(G) Service of this type of extinguisher may only be carried out if the extinguisher meets the criteria of the ‘critical uses’ in Annex VII of EC Regulation 2037/2000.
(H) Intervals for carbon dioxide extinguishers: BS EN 1802: 2002 (Clause 5), BS EN 1803: 2002 (Clause 5), and BS EN 1968: 2002 (Clause 5) require that the stamped date of manufacture or last overhaul be used.
6.3.4 Disposal of medium

BS 5306-3 states: ‘Attention is drawn to environmental legislation, especially where this concerns the disposal of media that have been replaced during the course of the maintenance procedures.’ There are a number of legislative controls governing the disposal of unwanted media from fire extinguishers, such as Groundwater Regulations 1998, Water Resources Act 1991, Water Industries Act 1991, Environmental Protection (Duty of Care) Regulations 1991, Control of Pollution (Amendment) Act 1989/Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991, Hazardous Waste Regulations 2005, and the Trade Effluents (Prescribed Processes and Substances) Regulations 1989.

The following outlines actions to take for each type of media:

- **Firefighting foams:** In accordance with the Groundwater Regulations, these must not be discharged to groundwater. Foams (except PFOS-based foams) may be disposed of via foul sewer to a waste water treatment plant (sewage works), although there are some concerns regarding this and the engineer must check with the site whether it is permitted. PFOS foams must be disposed of by high temperature incineration. Between one and five extinguishers may be disposed of on site via the foul water system. Where there are more than five extinguishers for disposal, foam should be collected in a secure container and transferred to a larger container at the service depot for disposal by licenced waste contractors.

- **Firefighting powders:** The method of disposal depends on the type of powder, and the powder manufacturer should be consulted to ascertain the appropriate route. Certain powder types are classed hazardous waste and a hazardous waste consignment note must be completed and retained with disposal arranged through a licenced carrier. Some powder types may go to landfill sites in sealed containers, as they are classified biodegradable solid waste. Where agricultural use is considered a possible disposal option, it is necessary to consider whether the powder has a silicone coating as this will need to be removed. If discharge testing is conducted on site, care should be taken to avoid powder escaping into the environment. Discharge into a large canvas bag is recommended, and the bag should be sealed to prevent leaks.

- **Wet chemical:** These media should not be disposed via foul sewer or landfill sites. Again, the manufacturer should be consulted when considering disposal options, as Class F media contains a mixture of chemicals.

- **Water:** Suitable disposal is via foul water system, unless additives have been added. Alternatively, these extinguishers can be used as part of staff training.

- **Carbon dioxide:** Normal practice is for these extinguishers to be returned to an approved service centre, which will arrange safe discharge of contents. These may also be used for staff training.

The Montreal Protocol and the Ozone Depleting Substances EC Regulation 2037/2000 introduced limitations on the use of halon. These have been updated by the Ozone Depleting Substances EC Regulation 1005/2009 and the Ozone-Depleting Substances (Qualifications) Regulations 2009.
Further information

British Standards
- BS EN 2: Classification of fires
- BS EN 3: Portable fire extinguishers
- BS EN 1802: Transportable gas cylinders. Periodic inspection and testing of seamless aluminium alloy gas cylinders
- BS EN 1803: Transportable gas cylinders. Periodic inspection and testing of welded carbon steel gas cylinders
- BS EN 1866: Mobile fire extinguishers. Characteristics, performance and test methods
- BS EN 1968: Transportable gas cylinders
- BS EN ISO 9001: Quality management systems. Requirements
- BS EN ISO 17021: Conformity assessment. Requirements for bodies providing audit and certification of management systems
- BS 5045: Transportable gas containers
- BS 5306-3: Code of Practice for the commissioning and maintenance of portable fire extinguishers
- BS 5306-8: Fire extinguishing installations and equipment on premises. Selection and installation of portable fire extinguishers
- BS 5423: Specification for portable fire extinguishers
- BS 6165: Specification for small disposable fire extinguishers of the aerosol type
- BS 6643-1: Recharging fire extinguishers (manufactured to BS 5423: Specification for portable fire extinguishers). Specification for procedure and material
- BS 6643-2: Recharging fire extinguishers (manufactured to BS 5423: Specification for portable fire extinguisher). Specification for powder refill charges
- BS 7863: Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers

BAFE schemes
- MP101: Manufacture of Portable Fire Extinguishers
- SP101/ST104: Contract Maintenance of Portable Fire Extinguishers incorporating Registered Fire Extinguisher Service Technicians Scheme
- SP103: Refurbishment of Portable Fire Extinguishers
Legislation
  • Carriage of Dangerous Goods and Use of Transportable Pressure Receptacles Regulations 2009
  • Control of Pollution (Amendment) Act 1989/Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991
  • Environmental Protection (Controls on Ozone-Depleting Substances) Regulations 2002 and 2003
  • Environmental Protection (Duty of Care) Regulations 1991
  • F Gas Regulations 2006
  • Fire (Scotland) Act 2005
  • Fire and Rescue Services (Northern Ireland) Order 2006
  • Fire Safety (Northern Ireland) Regulations 2006
  • Fire Safety (Scotland) Regulations 2006
  • Groundwater Regulations 1998
  • Hazardous Waste Regulations 2005
  • Montreal Protocol
  • Ozone Depleting Substances Minimum Qualifications Regulations 2006
  • Pressure Equipment (Amendment) Regulations 2002
  • Pressure Equipment Regulations 1999
  • Pressure Systems Safety Regulations 2000
  • Regulatory Reform (Fire Safety) Order 2005
  • Transportable Pressure Equipment Directive (TPED)
  • Water Industries Act 1991
  • Water Resources Act 1991

Other publications
  • *Choosing and Using a Fire Extinguisher* (pocket card), Fire Protection Association
  • *Essentials of Fire Safety Management*, Fire Protection Association
  • *Extinguishing Fires at Work DVD*, Fire Protection Association
  • *FPA Workplace Fire Safety Log Book*, Fire Protection Association
  • *Fire Risk Assessment for Small Businesses*, Fire Protection Association
  • *Fire Risk Management in the Workplace, A Guide for Employers*, Fire Protection Association
  • *How to Use a Fire Extinguisher* (leaflet), Fire Protection Association
# Index

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.065 calculations</td>
<td>32, 34</td>
</tr>
<tr>
<td>35kV conductivity test</td>
<td>23, 25</td>
</tr>
<tr>
<td>ABC powders</td>
<td></td>
</tr>
<tr>
<td>see Extinguisher types</td>
<td></td>
</tr>
<tr>
<td>Aerosol containers</td>
<td>8</td>
</tr>
<tr>
<td>Alcohol-resistant foam (AR)</td>
<td></td>
</tr>
<tr>
<td>see Extinguisher types</td>
<td></td>
</tr>
<tr>
<td>Alkali metals</td>
<td>27</td>
</tr>
<tr>
<td>Aqueous film-forming foams (AFFF)</td>
<td></td>
</tr>
<tr>
<td>see Extinguisher types</td>
<td></td>
</tr>
<tr>
<td>Aqueous solutions</td>
<td>24, 30</td>
</tr>
<tr>
<td>Asphyxiate/asphyxiant</td>
<td>29, 33</td>
</tr>
<tr>
<td>Auto-ignition temperature</td>
<td>15</td>
</tr>
<tr>
<td>BAFE schemes</td>
<td></td>
</tr>
<tr>
<td>MP101</td>
<td>12, 45</td>
</tr>
<tr>
<td>SP101/ST104</td>
<td>12, 39, 45</td>
</tr>
<tr>
<td>SP103</td>
<td>12, 45</td>
</tr>
<tr>
<td>BC powders</td>
<td></td>
</tr>
<tr>
<td>see Extinguisher types</td>
<td></td>
</tr>
<tr>
<td>British Approvals for Fire</td>
<td></td>
</tr>
<tr>
<td>Equipment (BAFE)</td>
<td>12, 20, 38-39, 45</td>
</tr>
<tr>
<td>British Fire Consortium (BFC)</td>
<td>38</td>
</tr>
<tr>
<td>British Standards</td>
<td></td>
</tr>
<tr>
<td>BS EN 2</td>
<td>16, 39, 45</td>
</tr>
<tr>
<td>BS EN 3</td>
<td>8-10, 12, 18, 20-21, 23, 25, 30, 39, 42, 45</td>
</tr>
<tr>
<td>BS EN 1802</td>
<td>9, 11, 43, 45</td>
</tr>
<tr>
<td>BS EN 1803</td>
<td>9, 11, 43, 45</td>
</tr>
<tr>
<td>BS EN 1866</td>
<td>28, 45</td>
</tr>
<tr>
<td>BS EN 1968</td>
<td>9, 11, 45</td>
</tr>
<tr>
<td>BS EN ISO 9001</td>
<td>12, 45</td>
</tr>
<tr>
<td>BS EN ISO 17021</td>
<td>12, 45</td>
</tr>
<tr>
<td>BS 5045</td>
<td>29, 45</td>
</tr>
<tr>
<td>BS 5306-3</td>
<td>11, 20, 39-44, 45</td>
</tr>
<tr>
<td>BS 5306-8</td>
<td>11-12, 21, 34-35, 39-40, 45</td>
</tr>
<tr>
<td>BS 5423</td>
<td>11-12, 42, 45</td>
</tr>
<tr>
<td>BS 6165</td>
<td>9, 11, 45</td>
</tr>
<tr>
<td>BS 6643-1</td>
<td>12, 42-43, 45</td>
</tr>
<tr>
<td>BS 6643-2</td>
<td>42, 45</td>
</tr>
<tr>
<td>BS 7863</td>
<td>9-10, 45</td>
</tr>
<tr>
<td>British Standards Institution (BSI)</td>
<td>8, 20, 39</td>
</tr>
<tr>
<td>see also British Standards</td>
<td></td>
</tr>
<tr>
<td>Basic service</td>
<td>11, 43</td>
</tr>
<tr>
<td>Biodegradable solid waste</td>
<td>44</td>
</tr>
<tr>
<td>Burning rate</td>
<td>14</td>
</tr>
<tr>
<td>Business continuity</td>
<td>7</td>
</tr>
<tr>
<td>CE mark</td>
<td>39, 41</td>
</tr>
<tr>
<td>Call-points</td>
<td>36</td>
</tr>
<tr>
<td>Caesium</td>
<td>27</td>
</tr>
<tr>
<td>Calculation methods</td>
<td>12, 32, 34</td>
</tr>
<tr>
<td>Carbon dioxide (CO₂) extinguishers</td>
<td></td>
</tr>
<tr>
<td>see Extinguisher types</td>
<td></td>
</tr>
<tr>
<td>Carbon dioxide (pressurising medium)</td>
<td>19, 20</td>
</tr>
<tr>
<td>Caretakers</td>
<td>8</td>
</tr>
<tr>
<td>Carriage of Dangerous Goods and Use of Transportable Pressure Receptacles Regulations 2009 see Legislation</td>
<td></td>
</tr>
<tr>
<td>Cartridge seal</td>
<td>19, 42</td>
</tr>
<tr>
<td>Chemical decomposition</td>
<td>14</td>
</tr>
<tr>
<td>Chemical interference</td>
<td>16, 17</td>
</tr>
<tr>
<td>Class A risks</td>
<td>16, 17, 21, 22-24, 26, 32-34</td>
</tr>
<tr>
<td>Class B risks</td>
<td>16, 17, 21, 24, 26-28, 34-35</td>
</tr>
<tr>
<td>Class C risks</td>
<td>16, 17, 21, 26, 28, 33</td>
</tr>
<tr>
<td>Class D risks</td>
<td>16, 17, 21, 27, 28</td>
</tr>
<tr>
<td>Class F risks</td>
<td>16, 17, 21, 24, 30, 33, 44</td>
</tr>
<tr>
<td>Classes of fire</td>
<td>13, 16, 24, 39-40</td>
</tr>
<tr>
<td>Colour coding</td>
<td>9-11, 45</td>
</tr>
<tr>
<td>Combustion</td>
<td>13-17</td>
</tr>
<tr>
<td>Commissioning</td>
<td>11, 38, 44</td>
</tr>
<tr>
<td>Compaction test</td>
<td>10</td>
</tr>
<tr>
<td>Competent person</td>
<td>7, 33, 38-43</td>
</tr>
<tr>
<td>Computers</td>
<td>23, 33</td>
</tr>
<tr>
<td>Condemned extinguishers</td>
<td>12, 40-41</td>
</tr>
<tr>
<td>Conduction</td>
<td>15</td>
</tr>
<tr>
<td>Contained burning liquid fire</td>
<td>24</td>
</tr>
<tr>
<td>Convection</td>
<td>15</td>
</tr>
<tr>
<td>Cooking oil</td>
<td>17, 23</td>
</tr>
<tr>
<td>Cooling (suppression/extinguishing method)</td>
<td>16, 17, 22, 24, 26-27, 30, 33</td>
</tr>
<tr>
<td>Corridors</td>
<td>36</td>
</tr>
<tr>
<td>Critical temperatures</td>
<td>14</td>
</tr>
<tr>
<td>Critical users</td>
<td>17, 19, 31</td>
</tr>
<tr>
<td>Cylinders of flammable gases or highly flammable liquids</td>
<td>8</td>
</tr>
<tr>
<td>D powders</td>
<td></td>
</tr>
<tr>
<td>see Extinguisher types</td>
<td></td>
</tr>
<tr>
<td>Deep fat fryer</td>
<td>16, 24, 30</td>
</tr>
</tbody>
</table>

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*Note: The page numbers may not exactly correspond to the actual page locations in the document.*
Control of Pollution (Amendment) Act 1989/
Controlled Waste (Registration of
Carriers and Seizure of Vehicles)
Regulations 1991 ......................... 44, 46
Environmental Protection (Duty of Care)
Regulations 1991 ......................... 44, 46
European Pressure Equipment
Directive ................................. 39
F Gas Regulations 2006 .................. 44, 46
Fire (Scotland) Act 2005 ................. 6, 46
Fire and Rescue Services
(Northern Ireland) Order 2006 ........... 6, 46
Fire Safety (Northern Ireland)
Regulations 2006 ......................... 6, 46
Fire Safety (Scotland)
Regulations 2006 ......................... 6-7, 46
Groundwater Regulations 1998 .......... 44, 46
Hazardous Waste Regulations 2005 ....... 44, 46
Montreal Protocol ........................ 17, 31, 44, 46
Ozone Depleting Substances Minimum
Qualifications Regulations 2006 .......... 44, 46
Pressure Equipment (Amendment)
Regulations 2002 ......................... 8, 46
Pressure Equipment
Regulations 1999 ......................... 8, 46
Pressure Systems Safety
Regulations 2000 ......................... 8, 46
Regulatory Reform (Fire Safety)
Order 2005 ................................ 6-7, 46
Transportable Pressure Equipment
Directive (TPED) .......................... 8, 46
Water Industries Act 1991 ............... 44, 46
Water Resources Act 1991 ............... 44, 46
Life safety ............................... 7
Lithium .................................. 27
Lobbies .................................. 36
Loss Prevention Certification
Board (LPCB) ............................. 39
Lower Explosive Limit (LEL) ............ 14
Magnesium .............................. 16, 17
Maintenance intervals .................... 43
Means of escape see also Escape routes 8
Metal fires ............................. 21, 27
Mounting and labelling .................. 12, 37
Multiple occupancy ..................... 34
Night watchmen .......................... 8
Non-compliant extinguishers ............ 41
Non-refillable fire extinguishers ....... 11, 41
Not maintained .......................... 40
Occupational fire brigade ............... 8
Operation time .......................... 9
Overhaul ............................... 11, 39, 40, 42, 43
Oxygen ................................. 13-16, 26, 29, 30
Patrol staff ............................. 8
Photocopier ............................. 16
Piercing disc ............................ 20
Post-mix foam ........................... 27
Potassium ............................... 30
Potassium acetate ....................... 30
Potassium bicarbonate ................... 27
Potassium carbonate ..................... 30
Potassium citrate ....................... 30
Practical considerations ............... 39
Pre-mix foam ............................ 27
Pressure Equipment (Amendment)
Regulations 2002 see Legislation
Pressure Equipment Directive see Legislation
Pressure Equipment Regulations 1999 see Legislation
Pressure test ........................... 11
Pressure vessel .......................... 10, 19
Protein foams (P) see Extinguisher types
Radiation ............................... 15
Re-ignition ............................. 24-25, 26-28, 30, 33
Recharging ............................. 11, 20, 40, 42-43, 45
Regulatory Reform (Fire Safety) Order 2005 see Legislation
Relevant person .......................... 6-7
Relevant premises ....................... 6-7
Replacement of components ............ 12, 29, 43
Reports see Written reports
Responsible person ........................ 7, 38, 40-42, 43
Safety pin ............................... 19, 20, 42
Security staff ............................ 8
Semi-fluid crust .......................... 27
Service staff ............................. 39-40
Servicing schedules ..................... 41
Shavings ............................... 14
Silicone coating ......................... 44
Single occupancy ....................... 32, 34
Siting requirements ..................... 36-37
Smothering ............................. 16, 17, 21
Soda acid extinguishers ............... 41
Sodium ................................. 27
Special fire extinguishers .............. 17
Spillage ............................... 24, 34-35
Spontaneous ignition/combustion ....... 14-15
Spray coatings .......................... 15
Spray lance ............................. 19
Spray nozzle ..... 19, 37
Squeeze grip ..... 19
Stairways ..... 36
Starvation ..... 16, 17
Stored pressure ..... 10, 19, 23, 24, 27, 41, 43
Stretch test ..... 11
Suppression methods ..... 16-17
Syphon tube ..... 19, 24, 29
Test fires. ..... 21
Thermal insulator ..... 15
Third party accreditation/ certification ..... 12, 39
Titanium ..... 16, 17
Training ..... 7-8, 12, 17, 21, 38-39
Transportable Pressure Equipment Directive (TPED) ..... 8, 47
Travel distance. ..... 37
Types of extinguisher
   see Extinguisher types

UK Accreditation Service (UKAS) ..... 12
Upper Explosive Limit (UEL). ..... 14
User inspections ..... 41

Vaporisation ..... 14
Vapours, flammable ..... 14, 16, 24, 30
Vent holes ..... 42
Visual inspection ..... 36, 41

Water-based fire extinguishers
   see Extinguisher types
Water-miscible liquids ..... 25
Wet chemical
   see Extinguisher types
Written reports and documentation ..... 40