

BS 5306-8:2012



BSI Standards Publication

Fire extinguishing installations and equipment on premises

Part 8: Selection and positioning of portable fire extinguishers – Code of practice

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Foreword

Publishing information

This part of BS 5306 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 October 2012. It was prepared by Technical Committee FSH/2, *Fire extinguishers*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 5306 supersedes BS 5306-8:2000, which is withdrawn.

Relationship with other publications

The other parts of BS 5306 published are as follows:

- Part 0: *Guide for selection of installed systems and other fire equipment*;
- Part 1: *Hose reels and foam inlets*;
- Part 2 (obsolescent): *Specification for sprinkler systems*;
- Part 3: *Commissioning and maintenance of portable fire extinguishers – Code of practice*;
- Part 4: *Specification for carbon dioxide systems*;
- Part 5: *Halon systems*:
 - Section 5.1: *Specification for halon 1301 total flooding systems*;
 - Section 5.2: *Specification for halon 1211 total flooding systems*.

This part of BS 5306 is intended to be read in conjunction with BS EN 2 and BS EN 3 (see also *Information about this document*).

Information about this document

Well maintained and professionally installed fire extinguishers are fundamentally safe and easy to use. Research has shown that extinguishers are successful in a significant number of fires each year and make a major contribution to first aid fire safety.

This is a full revision of the standard, and introduces the following principal changes:

- recognition of changes in relevant legislation;
- recommendations added on environmental impact;
- information on the use of powder revised;
- clarification on the requirements for class A hazards;
- changes in the recommendations for class B and class C hazards;
- erroneous reference to class E removed;
- references to fire blankets removed;
- travel distances revised;
- changes to the recommendations on signs;
- calculation examples updated;
- advice on reducing vandalism added;

- recommendations added on the preservation of service information;
- advice added on extinguisher discharge characteristics.

The rating system of BS EN 3, in which the fire performance of extinguishers on class A and class B fires, as defined in BS EN 2, are assessed on the basis of their ability to extinguish specified test fires, is used in this part of BS 5306 for the determination of the distribution of extinguishers on premises. In this revision, class B ratings recommended are determined by direct readings from tables to give the same result as by calculation but more simply. Additional consideration is given to factors that could affect the type of extinguisher selected for class A fires. Special precautions for class C and class D fires are outlined. Specific recommendations are given for controlling class F fires. The provisions of the present part of BS 5306 could in general be applied to the needs of a building or on a building site.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

As a code of practice, this part of BS 5306 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 5306 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Attention is drawn to the following statutory regulations; this list is not to be taken as definitive or exhaustive:

- Regulatory Reform (Fire Safety) Order 2005 [1] and associated Guidance Notes;
- Fire Safety (Scotland) Regulations 2006 [2] and associated Guidance Notes;
- Fire Precautions (Workplace) Regulations (Northern Ireland) 2001 [3] and associated Guidance Notes;
- Fire (Scotland) Act 2005 [4];
- Fire Safety Regulations (Northern Ireland) 2010 [5];
- Health and Safety (Safety Signs and Signals) Regulations 1996 [6];

- Health and Safety (Safety Signs and Signals) Regulations (Northern Ireland) 1996 [7];
- Pressure Systems Safety Regulations 2000 [8];
- Pressure Systems Safety Regulations (Northern Ireland) 2004 [9];
- Transportable Pressure Vessels Regulations 2001 [10];
- Transportable Pressure Vessels Regulations (Northern Ireland) 2003 [11];
- Environmental Protection (Controls on Ozone-Depleting Substances) (Amendment) Regulations 2011 [12];
- Controls on Ozone-Depleting Substances Regulations (Northern Ireland) 2011 [13];
- Health and Safety at Work Act etc. 1974 [14];
- Management of Health and Safety at Work Regulations 1999 [15];
- Management of Health and Safety at Work Regulations (Northern Ireland) 2000 [16].

Introduction

It is important for the fire protection of a building to be considered as a whole. Portable fire extinguishers form an important part of such facilities, although it cannot be assumed that their provision entirely obviates the need for other protection, e.g. internal rising main, hose reels, sprinklers, other automatic or manual extinguishing systems, mobile extinguishing units, and fire alarm systems.

Portable fire extinguishers are valuable in the early stages of fire when their portability and immediate availability for use by one person enable a prompt attack to be made. They cannot be expected to deal with a large fire since they are essentially first aid fire-fighting appliances of a limited capacity.

The recommendations of this part of BS 5306 are intended to assist the person(s) responsible for the safety of the building in planning to control the consequences of possible fires.

It is a legal obligation to ensure that subsequent preventative and protective measures are carried out by a competent person. It is important to note that the carrying out of a fire risk assessment is part of the duty of care legally required of the responsible person having control of a workplace.

Advice on such matters can be obtained from fire engineering companies, fire authorities, the Health and Safety Executive, fire insurers and fire safety consultants.

1 Scope

This part of BS 5306 gives advice and guidance on the suitability and positioning of portable fire extinguishers, primarily those conforming to BS EN 3, that can be carried by one person and that are used for the protection of buildings, other premises, contents and to assist evacuation.

This part of BS 5306 is not applicable to aircraft, caravans or marine craft.

NOTE Portable fire extinguishers for use in aircraft are specified in BS 7867, their provision in caravans is dealt with in BS 3632 and BS EN 1645-1, whilst those for marine craft and motor vehicles are the subject of a number of international agreements, government regulations and advisory publications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5306-3, *Fire extinguishing installations and equipment on premises – Part 3: Commissioning and maintenance of portable fire extinguishers – Code of practice*

BS 7863, *Recommendations for colour coding to indicate the extinguishing media contained in portable fire extinguishers*

BS EN 2, *Classification of fires*

BS EN 3 (all parts), *Portable fire extinguishers*¹⁾

¹⁾ This standard also gives informative references to BS EN 3-7:2004+A1:2007.

3 Terms and definitions

For the purposes of this part of BS 5306, the following terms and definitions apply.

3.1 charge

mass or volume of extinguishing medium contained in an extinguisher

NOTE The charge of a water-based medium is expressed as a volume in litres. Charges for other media are expressed as a mass in kilograms.

3.2 clean agent

electrically non-conducting, volatile or gaseous, fire extinguishing medium that does not leave a residue upon evaporation

3.3 competent person

person with enough training, experience or knowledge and other qualities to be able to assist in the implementation of preventative and protective measures

NOTE The competent person is often the competent person undertaking the maintenance of extinguishers as defined in BS 5306-3.

3.4 extinguishing medium

substance contained in an extinguisher which causes extinction of a fire

3.5 fire extinguisher

appliance containing an extinguishing medium which can be expelled by the action of internal pressure and be directed on to a fire

NOTE This pressure can be stored in the body or produced by the release of an auxiliary gas.

3.6 fire hazard

source or situation with potential to result in a fire

NOTE Examples of fire hazards include ignition sources and accumulation of waste that could be subject to ignition. Guidance is given in PAS 79.

3.7 fire risk

combination of likelihood and consequence(s) of fire

NOTE In the context of this standard, the relevant consequences are those involving injury to people, as opposed to damage to property. Guidance is given in PAS 79.

3.8 fire risk assessment

overall process of identifying fire hazards and evaluating the risks to life and property arising from them, taking account of existing risk controls (or, in the case of a new activity, proposed risk controls)

NOTE A fire risk assessment is a legal requirement for virtually all non-domestic premises, and for certain multiple-occupancy dwellings and parts of such dwellings. Guidance is given in PAS 79.

3.9 flash-spread

rapid transfer of ignition between grouped open-topped containers of flammable liquids if any member of the group becomes ignited

3.10 portable fire extinguisher

fire extinguisher which is designed to be carried and operated by hand and which, in working order, has a mass of not more than 20 kg

NOTE Hereinafter referred to as an "extinguisher".

3.11 responsible person

person or persons responsible for, or having effective control over, fire safety provisions adopted in or appropriate to the premises or building or fire hazard where an extinguisher is installed

NOTE For the purposes of this part of BS 5306, the term "responsible person" includes a nominated representative, and is the person defined by this term in the Regulatory Reform (Fire Safety) Order 2005 [1].

3.12 storey

floor or level within a building, including basements and mezzanines and ground floor

4 Provision of extinguishers – General recommendations

4.1 Importance of early planning

Although portable extinguishers are not permanent fittings in a structure, they form part of the whole concept of fire protection, and in new buildings their provision should be taken into account at the design stage. When the use of the building has been decided, or, for existing structures, if the use or layout is to be changed, a fire risk assessment should be carried out. The findings of this fire risk assessment should be used to help determine requirements for increased levels of extinguisher cover above the scale of provision of portable extinguishers as recommended in Clause 8.

NOTE Attention is drawn to the legal obligation to ensure that preventative and protective measures are carried out by a competent person.

4.2 The environment

The impact of the discharge of the extinguishing medium on the environment should be taken into account.

Extinguishing medium can cause collateral damage to many things such as, but not restricted to, food, machinery, building fabric, fixtures, fittings, artefacts and sensitive equipment. Expert advice on the impact of the discharge from a fire extinguisher on the local environment should be sought from a competent person.

Advice on the impact of extinguishers (and their content) on the wider environment should be sought from extinguisher manufacturers and distributors.

4.3 Erection, refurbishment and demolition of buildings

The results of a fire risk assessment should identify the types and numbers of extinguishers in the following circumstances:

- a) during the erection of a building, particularly where material or equipment is stored pending use or installation;
- b) when a building is in process of demolition;
- c) where any part of a building is brought into occupation prior to completion.

4.4 Unoccupied buildings

The responsible person or competent person should assess the provision of extinguishers where buildings, or parts thereof, are unoccupied.

4.5 Training in the use of extinguishers

The competent person should bring to the attention of the responsible person the legal requirement for training. Every opportunity should be taken to instruct personnel in the use of extinguishers, and to demonstrate their performance.

Extinguishers for different fire classifications will have different training requirements.

NOTE Attention is drawn to legal obligations concerning training for the use of fire extinguishers.

4.6 Avoidance of multiplicity of types

To avoid confusion, all extinguishers installed in any one storey of a building or single occupancy should have the same method of operation and, if intended for the same function, should all be similar in shape, appearance and colour.

4.7 Commissioning and maintenance

The extinguishers referred to in this part of BS 5306 should be commissioned, inspected, tested and maintained by a competent person in accordance with BS 5306-3.

5 Extinguisher characteristics

5.1 General

A fire extinguisher is described by the type of extinguishing medium it contains. At present there are:

- water-based, including foam and wet chemical (see Note 1);
- powder;
- carbon dioxide;
- clean agent, including halon (see Note 2).

NOTE 1 Water-based extinguishers can be produced with or without a low-freeze additive.

NOTE 2 Attention is drawn to European Council Regulations EC 1005/2009 [17] and EU 744/2010 [18] concerning the use of halons.

Extinguishers conforming to BS EN 3 range from approximately 2 kg to 20 kg total mass, the latter being the maximum that it is considered a person can satisfactorily carry and use effectively. Those provided should be of a size that can conveniently be carried by the occupants of the building in which they are placed, and should have the appropriate class as shown in Clause 7. The class and rating system compares extinguishers by their ability to extinguish different types and sizes of test fire.

5.2 Fire ratings

Fire ratings of extinguishers are determined during controlled tests by experienced users. When using the fire rating of an extinguisher to calculate the required levels of coverage, it is therefore important to take into account the total discharge time of the extinguisher, and its range of discharge, in combination with the levels of experience of the potential users.

Extinguishers conforming to withdrawn British Standards (e.g. BS 5423, BS 7937) might still be found in service. These are still acceptable as part of the extinguisher provision for the premises provided that they can be returned to a serviceable state; and additionally are marked with a fire rating.

5.3 Temperature range

Extinguishers manufactured in accordance with BS EN 3 have a temperature range marked, outside which the discharge and fire rating cannot be guaranteed.

If extinguishers are sited in locations where temperatures approach the limits of this range, then either measures should be taken to protect the extinguisher from the extremes of temperature, or alternative extinguisher types should be specified that have a more appropriate temperature range for the hazard in that location.

Use of any low-freeze additive other than that recommended by the manufacturer can cause corrosion and/or affect the fire-fighting performance. Therefore the low-freeze additive recommended by the manufacturer should be used for recharging extinguishers.

5.4 Discharge

5.4.1 Distance and direction

The distance over which an extinguisher can expel its content should be taken into account when specifying an extinguisher for a defined hazard. A jet type discharge will travel a considerably further distance than a spray type discharge. This affects both horizontal and vertical discharge distance and might be of particular importance in areas that have shelving or racking.

Light or gaseous extinguishing media such as carbon dioxide or clean agent should not be specified where wind or draughts could adversely affect the distance of the discharge or unexpectedly change the direction of the discharge away from the fire. Such media should be specified where the medium is required to search for the fire, e.g. through a vent or grille and into the shell of electrical equipment.

5.4.2 Conductivity

Only non-conductive extinguishing media, such as carbon dioxide, powder or other clean agent, should be specified for use on electrical equipment.

NOTE Some water-based models with a spray type discharge have passed the discharge conductivity test in BS EN 3. This does not necessarily mean that these types can be used directly on fires involving electrical equipment. However, if the discharge of one of this type, being operated in the fashion prescribed by the manufacturer, inadvertently splashes onto electrical equipment, then the spray type discharge will afford the user more protection from electrical shock than the discharge from a jet type extinguisher or a spray type which has not passed the BS EN 3 conductivity test.

Responsible persons and potential users should be made aware that electrical equipment needs to be switched off before any extinguisher is discharged onto it.

5.4.3 Use of powder extinguishers

The discharge of a powder extinguisher within buildings can cause a sudden reduction of visibility and can also impair breathing, which could temporarily jeopardize escape, rescue or other emergency action. For this reason, powder extinguishers should generally not be specified for use indoors, unless mitigated by a health and safety risk assessment.

5.5 Colour coding

The colour coding of all portable extinguishers in a new installation should conform to the recommendations of BS 7863.

NOTE 1 BS EN 3 allows an area of up to 10% of the surface area of the extinguisher to be colour coded subject to national regulations. It is recognized that in an emergency, a user could be in danger of selecting the wrong equipment for the situation. Colour coding provides a means whereby the contents of fire extinguishers can be identified. BS 7863 provides this colour coding scheme.

NOTE 2 Further guidance on colour coding can be found in the appropriate Guidance Notes to references [1] to [3].

5.6 Gaseous extinguishing media

Three groups of gaseous extinguishing media can be used in portable extinguishers:

- carbon dioxide;
- halons, the use of which has been greatly restricted by the ratification of the Montreal Protocol [19];
- more complex mixtures of non-halon gases.

All of these groups are classified as clean agents.

WARNING. All three groups, and possibly decomposition products, are likely to be hazardous to persons in enclosed spaces with restricted ventilation.

Extinguishers using these media should not be installed in enclosed spaces with restricted ventilation, but cause little health risk when used in the open air, large rooms and other well-ventilated places inside buildings.

NOTE The use of halon fire extinguishers is limited by law (European Council Regulations EC 1005/2009 [17] and EU 744/2010 [18]). The effect of these Regulations is to prevent the use of halons other than 1211 and 1301 and to severely restrict the use of these two agents.

6 Positioning of extinguishers

6.1 Location and accessibility

Extinguishers should be available for immediate use at all times. Normally, extinguishers should be located:

- a) in conspicuous positions on brackets, on floor stands or within cabinets;
- b) where they will be readily seen by persons following an escape route;
- c) most suitably, near to room exits, corridors, stairways, lobbies and landings;
- d) in similar positions on each floor, where floors are of similar appearance;
- e) in accordance, additionally, with the recommendations given in 6.2, 6.3 and 6.4.

Extinguishers to tackle class B, class D, class F and fire involving electrical equipment should ideally be located such that the correct extinguisher for that fire type is the first one encountered by the prospective operator. This recommendation is most relevant where the prospective operator might not have received adequate training in the selection and use of extinguishers. It is also possible that even adequately trained operators could make an incorrect extinguisher choice when a fire is discovered, due to the alarming nature of that moment.

NOTE 1 The travel distances shown in 6.4 reflect the importance of this, and also take into account the importance of attempting to extinguish class B and class F fires as quickly as possible.

The position and type of a fire extinguisher should be indicated on a sign so that, if the extinguisher is removed, this can be identified during a safety inspection, and a replacement ordered.

NOTE 2 Attention is drawn to Health and Safety (Safety Signs and Signals) Regulations 1996 [6] and the Health and Safety (Safety Signs and Signals) Regulations (Northern Ireland) 1996 [7] in respect of indicating the location of fire-fighting equipment.

Extinguishers should not be located:

- 1) where a potential fire might prevent access to them;
- 2) over or close to heating appliances;
- 3) in concealed positions behind doors, in cupboards or deep recesses;
- 4) where they might cause obstruction to exit routes;
- 5) in positions in rooms or corridors away from exit routes unless they are necessary to cover a particular hazard;
- 6) where they might be damaged, e.g. by hotel-housekeeping trolleys or food-chain roll-cages.

6.2 Visibility

Wherever practicable, extinguishers should be clearly visible and predominately red. Where this is not possible, through either position or colour, the extinguisher should be indicated by location signs.

6.3 Mounting

6.3.1 Height

Small extinguishers with a mass up to and including 4 kg should be mounted so as to position the handle approximately 1.5 m from the floor. The carrying handle of larger, heavier extinguishers should be approximately 1 m from the floor (but see Note).

WARNING. Care should be taken to ensure that extinguishers do not themselves cause injuries by being dislodged and falling onto limbs or bodies.

NOTE Extinguishers may also be positioned on fire-stands, fire-points or in cabinets, in which case these height recommendations need not be followed.

6.3.2 Brackets

Mounting brackets used to position extinguishers should:

- a) be suitable for the extinguisher;
- b) be fixed in accordance with the manufacturer's instructions;
- c) enable easy removal of the extinguisher; and
- d) make its method of removal obvious.

6.4 Travel distance

Extinguishers should be sited near to the fire hazard concerned, but not so near as to be inaccessible or to place the operator in undue danger in case of fire. They should be sited in such a way that it is not necessary to travel from the site of any fire to reach an extinguisher further than the following maximum distances:

- class A: 30 m;
- class B: 10 m;
- class C: 30 m;
- class D: case-by-case basis, by expert advice;
- class F: 10 m.

Where the prospective operator is required to pass through doorways to reach the nearest extinguisher, the above travel distances should be reduced to maintain a short time between discovery of a fire and the moment at which the prospective operator is able to start fighting the fire with the extinguisher concerned.

NOTE Travel distances for fires involving electrical equipment are covered in 9.4.

6.5 Protection against corrosion and vandalism

Extinguishers stored outdoors or in potentially corrosive atmospheres can become unsafe for use or inoperable in a relatively short period. If extinguishers are sited in such locations, then either measures should be taken to protect the extinguisher, or alternative extinguisher types should be specified that are specifically designed to withstand the environment in that location.

Extinguishers located in any public access environment, e.g. schools, colleges, public houses, hotels and retail outlets, are susceptible to vandalism or being stolen. Even minor tampering could result in the extinguisher not operating when called on to do so in a fire situation. Measures should be taken to reduce the possibility of extinguishers being vandalized or stolen if relocation of the extinguisher to a more secure location is neither desirable nor practical. Such measures could include, but are not limited to, protection covers, boxes and audible alarms.

Measures should be taken to protect the maintenance record affixed to the extinguisher.

7 Suitability of extinguishers for various classes of fire

7.1 Classes of fire

Extinguishers should be provided for dealing with any potential fire hazard identified in the fire risk assessment or by the competent person. They should be suitable for dealing with the appropriate class of fire, as defined in BS EN 2.

The suitability of extinguishers for dealing with the different classes of fire defined in BS EN 2 is indicated by a letter and a pictogram marked on the extinguisher in accordance with BS EN 3-7.

NOTE The classes defined in BS EN 2 are as follows:

- class A – fires involving solid materials, usually of an organic nature in which combustion normally takes place with the formation of glowing embers (these are normally carbonaceous fires);

- class B – fires involving liquids or liquefiable solids, except those covered more specifically by class F;
- class C – fires involving gases;
- class D – fires involving metals;
- class F – fires involving cooking media (vegetable or animal oils and fats) in cooking appliances.

For the purposes of this part of BS 5306, an additional fire hazard is identified:

- fires involving electrical equipment.

There is no recognized classification for this additional type of fire. Electricity in itself does not burn but can cause fires in class A, B, C, D and F materials.

The A, B and F designations marked on extinguishers are always accompanied by a figure indicating the rating of the extinguisher based on the size of fire that can be extinguished. The use of these numbers is explained in Clause 8.

7.2 Fires involving cooking media (class F fires)

Where class F fires are likely to be present, only extinguishers having the class F fire rating in accordance with BS EN 3-7 should be selected.

WARNING. It is most important that only extinguishers classified as suitable for use on class F fires are used on fat or cooking oil fires.

8 Distribution of extinguishers according to fire classification and rating of extinguisher

8.1 General

The type of extinguisher should be selected with regard to the characteristics peculiar to each, the occupancy of the building and the nature of the particular combustible materials and circumstances. The scale of provision of portable extinguishers recommended in this part of BS 5306 should be regarded as a minimum, which will need to be increased if the findings of the overall fire risk assessment of the building determine that a higher level of portable extinguisher cover is appropriate. Other fire-fighting equipment or systems might also be required in addition to the portable extinguisher cover recommended here. Where such other means are provided, the expert advice of a competent person should be sought on the scale of provision of that equipment. Fire extinguishers are first aid appliances and as such it is assumed that only one person is available to carry out fire-fighting. Distribution, quantity and fire-rating of extinguishers should take this into account.

NOTE The scheme of classification given in BS EN 2, and rating system given in BS EN 3, make it possible to specify the distribution of extinguishers in buildings according to extinguishing capability. This scheme requires that extinguishers are marked with numbers and letters indicating the relative maximum size and type of fire they are capable of extinguishing (under the conditions and procedures set out in BS EN 3). The test fires are carried out under ideal conditions by an experienced and trained operator. However, in a real fire situation, operators, although they are expected to have received some instruction and training in the use of extinguishers (see 4.5), have to be regarded as of limited experience. Conditions will rarely be ideal and fire, even if anticipated, will be unexpected. In a real fire situation, therefore, it cannot be expected that an extinguisher will be capable of extinguishing a fire of equal size to the test fire.

8.2 Class A – Fires involving solid materials, usually of an organic nature in which combustion normally takes place with the formation of glowing embers

NOTE These are normally carbonaceous fires.

8.2.1 Minimum quantities of class A extinguishers required

Class A materials are generally present in all premises and occupancies. The minimum quantity of extinguishers with an A rating should be calculated as follows:

- a) for any storey with a floor area less than or equal to 400 m², there should be:
 - 1) at least two (2) extinguishers with a class A rating; having
 - 2) a combined minimum total fire rating of 26A;
- b) for any storey with a floor area exceeding 400 m², there should be:
 - 1) at least two (2) extinguishers with a class A rating; having
 - 2) a combined minimum total fire rating of 0.065 × floor area of the storey (in square metres).

NOTE The provisions for class A fires are similar to previously accepted practice. This is based on the assumption that a 9 L (2 gallon) water extinguisher can achieve a 13A fire rating.

8.2.2 Additional extinguishers to the minimum class A provision

The minimum provision (8.2.1) is applicable to a wide range of occupancies, but additional extinguishers should be provided in locations where a fire could be particularly intense, and/or that are identified by the fire risk assessment or the competent person.

NOTE Advice on such matters can be obtained from fire engineering companies, fire authorities, the Health and Safety Executive, fire insurers and fire safety consultants.

8.2.3 Class A extinguishers – Travel distance

Once the calculations have been carried out and the minimum required number of extinguishers has been established, the maximum travel distance stipulated in 6.4 should be applied, and the number of extinguishers increased as necessary.

8.3 Class B – Fires involving flammable liquids

NOTE For cooking media, see 8.6.

8.3.1 General

Different types of extinguisher, of the same rating, have different characteristics, which in particular circumstances might make one type preferable to another. Mass for mass, powders are probably the most effective media against class B fires, but they are not effective against fires in which part of the fuel surface is shielded from the powder discharge. Re-ignition of the fuel is possible once the powder discharge ceases. This applies also to gaseous extinguishers.

Powders are the most effective media against “running” fires.

Foam is effective against contained fires where it will provide semi-permanent protection. With foam it is possible to partially extinguish a fire which will not regain full intensity for some time until the foam over the surface is destroyed. Foam can be applied to liquids in tanks to shield them from ignition from another source, or to prevent the evolution of flammable vapours.

Special types of foam should be provided for use against water miscible liquids or some types of solvent, e.g. alcohols, new blends of petrol.

8.3.2 Minimum quantities of class B extinguishers – Assessment process

8.3.2.1 General

Each room or enclosure having a class B fire hazard should be considered and assessed separately. The following calculations should then be made.

- Contained class B fire hazards more than 20 m apart should be calculated separately (see 8.3.2.2).
- Contained class B fire hazards sited within 20 m of another contained class B fire hazard should be calculated as either:
 - undivided groups, i.e. contained fire hazards less than 2 m apart (see 8.3.2.3); or
 - divided groups, i.e. contained fire hazards more than 2 m, but less than 20 m apart (see 8.3.2.4).
- Uncontained fire hazards, i.e. where a spillage of flammable liquid is possible, should be calculated separately (see 8.3.2.5).

8.3.2.2 Minimum quantity of class B extinguishers required where a single contained hazard exists

In order to determine the minimum recommended provision of foam extinguishers, firstly the area of the exposed class B hazard should be calculated, in square metres (m²). The first column in Table 1 should be read downwards until no less than the measured area has been reached. The minimum quantity and rating of class B extinguisher(s) recommended can be read from Table 1 by reading across to the second column.

Table 1 Provision of foam extinguishers for single open top containers

Maximum area of exposed class B m ²	Minimum quantity and minimum rating for each extinguisher
0.14	1 x 21B
0.23	1 x 34B
0.37	1 x 55B
0.47	1 x 70B
0.59	1 x 89B
0.75	1 x 113B
0.96	1 x 144B
1.22	1 x 183B
1.41	2 x 113B
1.80	2 x 144B
2.29	2 x 183B
2.88	3 x 144B
3.66	3 x 183B
4.66	3 x 233B

NOTE In a real fire situation, it cannot be expected that an extinguisher will be capable of extinguishing a fire of equal area to the test fire (see 8.1). For class B fires, a derating factor of 2.5 is therefore applied; that is, extinguishers are recommended as being suitable for extinguishing a real fire 40% of the area of the rated test fire. This is considered adequate when two extinguishers are installed, but if only one is to be installed the factor applied is 4.7.

Failure to extinguish a class B fire with any type of extinguisher except foam will result in the fire regaining its full intensity before a second extinguisher can be used. With foam extinguishers, however, progressive extinction is possible, i.e. if the fire is not extinguished by the first extinguisher used, partial extinction will be achieved and the fire will not regain its full intensity before an attack with a second extinguisher can be made.

The above factors have been used to calculate the values given in Table 1, which gives the areas of fire for which extinguishers are recommended as being suitable for use by operators of limited experience.

EXAMPLE 1

A single dip tank of surface area 1.0 m² is situated in a room. The recommended minimum rating is found from Table 1 as follows:

- a) Only one foam extinguisher is to be installed, 183B.

EXAMPLE 2

A vessel containing a maximum of 200 L of flammable liquid is positioned within a bund 1.3 m × 1.9 m of suitable depth. The recommended minimum rating is found from Table 1 as follows, using the area of the bund 1.3 × 1.9 = 2.47 m²:

- a) The installation of one extinguisher cannot be considered. The maximum area one extinguisher can cover is 1.22 m², which is less than the 2.47 m² of this bund.
- b) Three extinguishers (foam only) are to be installed, 144B.

8.3.2.3 Minimum quantities of class B extinguishers required where an undivided group of contained hazards exists

Containers less than 2 m apart should be considered as an undivided group, as equivalent to a single container. The sum of the surface area of all containers in the group should be calculated in square metres (m²), as this is used to determine the recommended rating. The minimum class B rating recommended can be read from Table 1 using this value, utilizing the same method as in 8.3.2.2. (See Example 3 and Figure 1.)

Where two open-topped containers are close together, a fire in one will almost certainly involve the other and both containers are therefore considered as forming a single fire hazard. A distance of 2 m is considered as the limiting distance of flash-spread from one container to the other, as it is an estimate of the distance within which vapour concentrations might be expected to exceed the lower flammable limit. This is, however, a somewhat arbitrary figure, as the flash-spread distance increases with increasing fire size because of the increased heating which might result. The distance is also dependent on the particular flammable liquid(s) concerned (because of differing vapour properties and of flame radiative powers), upon airflow and upon temperature conditions. In case of doubt, therefore, this limiting distance should be increased.

8.3.2.4 Minimum quantities of class B extinguishers required where a divided group of contained hazards exists

Containers more than 2 m but less than 20 m apart should be considered as forming a divided group. The greater surface area, in square metres (m²), of either:

- a) the largest container (or aggregate surface area of the largest undivided group); or

- b) one-third of the aggregate surface area of all the containers in the group; is used to determine the recommended rating. The minimum class B rating recommended can be read from Table 1 using this value, utilizing the same method as in 8.3.2.2. (See Example 3 and Figure 1.)

EXAMPLE 3: group of containers

Six open tanks are sited in a room, with spacing and surface areas as given in Figure 1.

Tank no. 1 is more than 20 m from the nearest tank and is therefore assessed separately (see 8.3.2.1). The area of the tank is 2.0 m² and the recommended minimum rating is found from Table 1 as follows:

- a) Two foam extinguishers are to be installed, 183B each.

The remaining tanks form a divided group, in which the largest tank has an area of 1.3 m² and tanks 3, 4 and 5 form an undivided group of aggregate area 1.6 m².

The total surface area of the five tanks in the divided group is 4.1 m². One third of this area is 1.37 m², more than the area (1.3 m²) of the largest single container but less than the aggregate area (1.6 m²) of the largest undivided group. The largest of the three values (1.6 m²) is used with Table 1 to find the recommended minimum rating as follows:

- b) Two foam extinguishers are to be installed, 144B each.

A summary of the minimum provision recommended for this room is:

Two 183B foam extinguishers for tank no. 1; and two 144B foam extinguishers for the remainder.

8.3.2.5 Minimum quantities of class B extinguishers required where a spill fire hazard exists

The recommended minimum rating of extinguishers to cover spillage of flammable liquid should be calculated from the anticipated volume of spillage as follows:

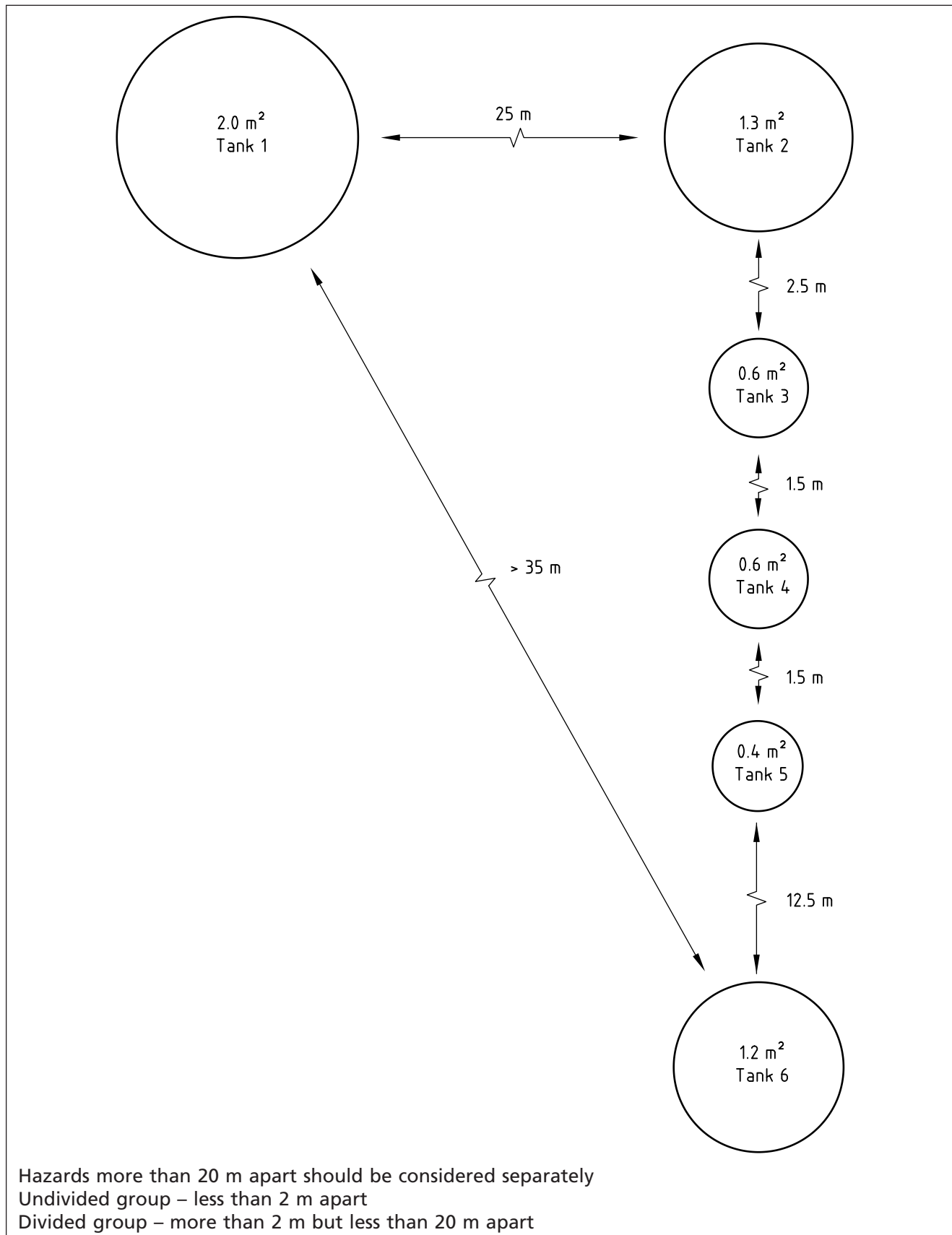
$$\text{Recommended minimum rating} = 10 \times \text{volume (in litres) of spillage}$$

The volume of spillage should be assessed according to the particular circumstances. In the case of non-spill-proof movable containers, it should be assumed that the whole contents of the largest movable container might spill. Large volume spillage into restricted areas such as bunds, cilled rooms and gullies should not be assessed by the formula given in this subclause, but should be regarded as a contained fire hazard of area equal to that of the restricted area.

Where calculations show that the B rating required is greater than that which can be provided by one extinguisher, alternative means of extinguishing (e.g. a wheeled unit) should be provided if necessary.

NOTE Fires involving spilled flammable liquids are variable quantities and it is difficult to predict their severity. Spillage to a depth of more than about 8 mm (such as large volume spillage into bunds, cilled rooms, gullies, etc.) is comparable to the case of a container of flammable liquid, and extinguishers need to be selected accordingly.

Figure 1 Grouping of class B hazards



Fuel depth has little effect on ease of extinction until the fuel depth is less than about 8 mm, when fires become easier to extinguish the smaller the depth. Ease of extinction then becomes more a function of volume of fuel than area of fire. Under normal circumstances spillage can be expected to spread to any depth up to a minimum of around 1 mm. Spillage to a depth of 1 mm of, for example, petrol could be expected to burn itself out in less than 0.5 min after ignition. Under these circumstances, extinguishers would be required only for any secondary fires, as the time available to attack the original spill fire would be so short.

At 8 mm depth, the volume of fuel, in litres, on the test fire is:

$$\frac{\text{Class B rating}}{4}$$

Applying a derating factor of 2.5 as above, this gives the maximum volume of spillage, in litres, for which extinguishers are recommended as:

$$\frac{\text{Class B rating}}{10}$$

Specially trained and experienced persons, particularly when working in groups and wearing protective clothing, can extinguish fires comparable to the BS EN 3 test fire for a particular extinguisher. In these circumstances an extinguisher is to be regarded not as a first-aid but as a specialized fire-fighting appliance. Recommendations for this type of application are not within the scope of this part of BS 5306.

EXAMPLE 4: minimum provision for spillage other than into restricted areas

If, within the room of Example 3, it is anticipated that spillages will not exceed a volume of 5 L, then the minimum rating of extinguisher recommended is:

$$10 \times 5 = 50 \text{ (i.e. 55B, powder)}$$

8.3.3 Additional extinguishers to the minimum scale of class B provision

The recommendations given in Table 1 are intended to cover the more common flammable liquids. Where liquids have a low flash point or are especially difficult to extinguish, such as petrol, higher rated extinguishers should be provided.

In areas protected by fixed systems, portable extinguishers should be provided to cover the risk of spillage or fires originating outside the coverage of the fixed equipment.

Where high rated extinguishers are installed, it is advisable to provide additional low rated extinguishers for use on small fires in preference to the higher rated extinguishers, to reduce contamination, replacement costs etc., and these should be sited close to the anticipated point of occurrence.

As class B fires are also more difficult to extinguish in still air conditions, additional extinguishers should be provided.

8.3.4 Class B extinguishers – Travel distance

Once the calculations have been carried out and the minimum required number of extinguishers has been established, the maximum travel distance stipulated in 6.4 should be applied, and the number of extinguishers increased as necessary.

8.4 Class C – Fires involving gases

8.4.1 General

If a person specially trained in extinguishing class C fires is not at the scene of the incident, the only safe method of extinguishing such fires is to cut off the flow of fuel to the leak. Locating and operating the flow control valves is therefore the preferred method of extinction. These actions should be carried out as a matter of extreme urgency.

If this cannot be done immediately, two opposing fire hazards are possibilities. These are: a) the jet of flame, contrasted with b) the filling of a volume with unburnt gas. A gas reservoir with free access of air will be liable to re-ignition at any time, possibly with explosive force. Unless the jet is playing directly upon some other combustible material, which should be covered with an appropriate extinguisher as recommended elsewhere in Clause 8, allowing the flame to continue is the least dangerous option until the flow can be stopped.

8.4.2 Minimum quantities of class C extinguishers required

Class C extinguishers should be provided for use by persons who have received special training in extinguishing class C fires (see 8.4.1). A detailed fire risk assessment and a health and safety risk assessment should be carried out where there is a hazard of class C fires occurring, to determine the number of class C extinguishers required.

NOTE The scope to BS EN 3-7:2004+A1 states: "Reference to the suitability of an extinguisher for use on gaseous fires (class C fires) are at the manufacturer's discretion, but are applied only to powder type extinguishers which have gained a class B or class A and class B rating."

8.4.3 Additional extinguishers to the minimum scale of class C provision

The number of additional extinguishers should be determined by fire risk assessment (see 8.4.2).

8.4.4 Class C extinguishers – Travel distance

The maximum travel distance stipulated in 6.4 should be applied, and the number of extinguishers increased as necessary (see 8.4.1).

8.5 Class D – Fires involving metals

8.5.1 General

For fires of combustible metals, specially formulated class D powder types of extinguisher should be used.

Other types of extinguisher should not be sited in areas where burning flammable metal is the major factor in the risk analysis. Traditional remedies such as sand buckets can be effective provided that the sand is clean and dry. The use of incorrect fire-fighting media can make an incident worse.

WARNING. Fires involving metals can be complicated by the presence of flammable liquids such as cutting lubricants, or by the metal itself melting.

8.5.2 Minimum quantities of class D extinguishers required

No special calculation will be needed, however, the type of combustible metal, and the area, depth and other characteristics of the fire which can be controlled and extinguished by particular extinguishers, should be established on a case-by-case basis from the manufacturer's literature.

8.5.3 Additional extinguishers to the minimum scale of class D provision

The requirement for additional extinguishers should be taken into account during the assessment recommended in 8.5.2.

8.5.4 Class D extinguishers – Travel distance

The maximum travel distance stipulated in 6.4 should be applied, and the number of extinguishers increased as necessary.

8.6 Class F – Fires involving cooking media (vegetable or animal oils and fats) in cooking appliances

8.6.1 General

For these fires the first action should be to cut off the source of heat input to the cooking container, if this can be done in safety, as this reduces the chance of re-ignition. Types of extinguisher other than those suitable for class F fires should not be sited in areas where cooking oils or fats is the major factor in the risk analysis.

WARNING. Failure to use class F extinguishing media can make a fire involving cooking media in cooking appliances significantly worse and is likely to spread the fire to the immediate vicinity of the appliance concerned.

If an area greater than 0.4 m² needs protection then a fixed extinguishing system should be provided.

8.6.2 Minimum quantities of class F extinguishers required

The first column in Table 2 should be read downwards until no less than the measured area has been reached. The minimum quantity and rating of class F extinguisher(s) recommended can be read from Table 2 by reading across to the second column.

Table 2 Provision of wet chemical (class F) extinguishers

Area of class F fire risk m ²	Extinguisher rating
0.015	1 × 5F
0.02	2 × 5F
0.04	1 × 25F
0.06	1 × 40F
0.11	1 × 75F
0.18	2 × 40F
0.24	2 × 75F
0.27	2 × 75F
0.3	2 × 75F
0.4	2 × 75F

NOTE Many cooking arrangements can restrict access to a fire by portable fire extinguishers. Examples are cooking tunnels for fume extraction, which only allow end access, or ranges set against a back wall. In these cases, the provision of a fixed fire extinguishing system might well be more appropriate than portable, class F fire extinguishers even if the calculation described in 8.6.2 shows that one or two portable fire extinguishers are suitable.

EXAMPLE 5: small pan

A pan of 21 cm diameter is used to cook chips. The area of this is approximately 0.035 m².

From Table 2, it can be seen that 1 × 25F rated extinguisher offers sufficient protection against the chip pan fire.

EXAMPLE 6: deep fat fryer

A fryer has a size of 0.5 m by 0.7 m. The area of the possible fire is therefore 0.35 m².

From Table 2, it can be seen that 2 × 75F rated extinguishers offers sufficient protection against the deep fat fryer fire.

8.6.3 Additional extinguishers to the minimum scale of class F provision

In areas protected by fixed systems, portable extinguishers should be provided to cover the risk of spillage or fires originating outside the coverage of the fixed equipment.

8.6.4 Class F extinguishers – Travel distance

The maximum travel distance stipulated in 6.4 should be applied, and the number of extinguishers increased as necessary.

8.7 Locations where more than one fire hazard type exists

Where multiple fire hazards exist in the same area, extinguishers should be provided to cover those fire hazards in accordance with the recommendations of this clause and chosen so as to minimize the number of different types of extinguisher in that area, taking note of the limitations of the various types given in 8.2 to 8.6. Travel distances should always be taken into account when rationalizing the number of extinguishers.

Firstly, the competent person should undertake the calculation for each of the fire classes as described in this clause. Secondly, they should use their product knowledge to combine extinguishers of different classes to provide sufficient extinguishers so that all fire hazards are adequately covered, having discussed the features and limitations of the various types with the responsible person.

EXAMPLE 7: combining extinguishers of different rating classes

A two-storey, single occupancy, industrial premises houses a business that uses flammable metals to manufacture metal pencil-sharpener. The ground floor area is 50 m × 20 m and contains electrical equipment necessary for the process. The main area contains all goods inward. The separate goods-out area has a door to a bunded storage room for their class B materials. The canteen has a kitchen area with a gas cooker and a deep fat fryer where catering staff provide luncheon for the employees. Upstairs there is an open plan office containing usual office equipment. The upper floor area is 20 m × 4 m.

Class A calculation:

The ground floor's (area 1 000 m²) minimum A-rating provision =
 $(50 \times 20) \times 0.065 = 65A$

The upper floor's (80 m²) minimum A-rating provision = 2 × A-rated
 extinguishers with combined A-rating no less than 26A

Class B calculation:

The only class B material is in the flammable store. The hazard presented is a single, closed-top, 8 L drum of solvent from which handheld sprayers are filled when necessary. The risk is therefore one of spillage.

The minimum B-rating requirement is $8 \text{ L} \times 10 = 89\text{B}$. A single extinguisher.

Class C calculation:

Gas is used for cooking in the canteen. Fire risk assessment and health and safety risk assessment identifies that 1 × class C extinguisher should be provided for use by the fire and rescue service, as there is no staff member on site specially trained to extinguish class C fires. 1 × 6 kg ABC or BC rated extinguisher.

Class D calculation:

After a special hazard assessment is made by the fire extinguisher service provider, it is appropriate that 4 × 9 kg class D fire extinguishers should be located around the process at all times.

Class F calculation:

The deep fat fryer used has an area of 0.35m^2 (0.5×0.7). This demands 2 × 75F extinguishers.

Fires involving electrical equipment

Fire risk assessment shows that extinguishers whose discharge is non-conductive by nature should be positioned all around the premises to counter fires in machinery downstairs and office equipment upstairs.

Summary of provision

This example shows that without rationalization the premises would need:

7 × purely class A extinguishers with a 13A rating

1 × purely class B extinguisher with an 89B rating

1 × purely class C extinguisher

4 × purely class D extinguishers

2 × purely class F extinguishers with a 75F rating

10 × purely "electrically safe" extinguishers

TOTAL 25 extinguishers

Rationalization principles:

Foam and ABC powder extinguishers with a class B rating have a class A rating also.

Wet chemical extinguishers with a class F rating often have a class A rating also.

Class D powder extinguishers rarely have any other ratings.

In consultation with the fire-extinguisher service provider, the business has decided it can tolerate the consequences of use of powder on the ground floor. If it were anything other than industrial then the residual mess could well be intolerable.

During the same consultation with the fire-extinguisher provider, the business has decided it would like to maintain as environmentally-friendly coverage as possible on the upper floor.

Travel distance should be maintained in accordance with this part of BS 5306.

Rationalization detail:

The class B hazard should be covered by an extinguisher that also has a class A rating; an ABC powder is the only recommended option as foam is not appropriate for class B spillage. This eliminates 1 × class A extinguisher from the list above, and as a powder was selected, it would also eliminate the need for a separate “electrically safe” extinguisher.

The class C hazard in the canteen should be covered by an extinguisher that also has a class A rating; a 13A/89B/C. This eliminates 1 × class A extinguisher and 1 “electrically safe” extinguisher from the list above.

The class F hazard in the canteen should be covered by extinguishers that also have a class A rating; a 13A/75F. This eliminates 2 × class A extinguishers from the list above, with the separate “electrically safe” extinguishers having already been eliminated.

All ground floor fire-points’ “electrically safe” extinguishers should be ABC powder extinguishers which, conveniently, have a class A rating.

Upstairs, the environmentally-friendly option is 2 × 13A water and 2 × carbon dioxide extinguishers arranged in two fire points, each holding one of each type.

Thus the rationalized provision is:

Canteen: 1 × 13A/89B ABC powder and 2 × 13A/75F wet chemical (with the wet chemical extinguishers nearest to the deep fat fryer).

Goods out: 1 × 13A/113B ABC powder.

Main process area: 2 × 13A/113B ABC powder and 4 × class D powder extinguishers (with the class D extinguishers nearest the process hazard hot-spots).

Upper floor offices: 2 × 13A water extinguishers and 2 × carbon dioxide extinguishers.

TOTAL NOW 14 extinguishers

i.e. 11 fewer than before rationalization.

9 Fires involving electrical equipment

9.1 General

For fires involving electrical equipment (see also 5.4.2), it is expected that the first action will be to cut off the source of power to the electrical equipment, if this can be done in safety. It is unlikely that the electrical equipment itself will provide the major fuel source. The provision of extinguishers should therefore be decided on the basis of the other fire hazards in the area.

9.2 Suitability of extinguishers for fires involving electrical equipment

Water-based extinguishers that do not pass the dielectric test specified in BS EN 3-7 are marked "DO NOT USE ON LIVE ELECTRICAL EQUIPMENT". However, for many years extinguishers of this type have of necessity been installed and used in premises where electric lighting fittings and power socket outlets are present. This use is acceptable subject to the advice given in Note 2. Where class F fires are likely to be present, extinguishers having a class F fire rating in accordance with BS EN 3 should be selected.

NOTE 1 Extinguishers having a class F fire rating might also be suitable for use on other fire classes.

NOTE 2 Water-based extinguishers can be marked as being suitable for use on live electrical equipment up to 1 000 V a.c. at a distance of 1 m in accordance with BS EN 3-7. The British Standards Technical Committee FSH/2 have stated that the national practice is "not marking the extinguisher if it passes the test in BS EN 3-7:2004+A1, Annex C, but marking a warning if the extinguisher failed the test or was not submitted". This practice refers to extinguishers manufactured in accordance with BS EN 3. Where there is uncertainty, seek guidance from the manufacturer.

NOTE 3 The use of carbon dioxide, clean agent or powder extinguishers on live electrical equipment does not increase the danger of electric shock from this type of equipment. Aqueous solutions are electrically conductive and when they are used, the danger of electric shock arises either by conduction of electric current along the discharge stream to the extinguisher or by conduction along wetted surfaces, including the floor, which can be touched by the extinguisher operator or other persons.

9.3 Distribution of extinguishers for fires involving live electrical equipment

Extinguishers of a type marked as suitable for use on fires in live electrical equipment should be sited near any electrical equipment (see also 5.4.2).

9.4 Travel distance

Extinguishers provided to deal with fires involving electrical equipment should be sited near to the fire hazard concerned, but not so near as to be inaccessible or to place the operator in undue danger in case of fire. The travel distance should be not more than 10 m.

10 Provision of replacement extinguishers

The responsible person should ensure that the provision of extinguishers on site does not fall below the minimum recommended by this part of BS 5306 and the fire risk assessment. Discharged extinguishers should therefore be recharged or replaced after use. This may be achieved by making sufficient spare extinguishers available.

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