MALAYSIAN STANDARD

MS 1539: PART 3:2003

SPECIFICATION FOR PORTABLE FIRE EXTINGUISHERS – PART 3: SELECTION AND INSTALLATION – CODE OF PRACTICE (FIRST REVISION)

ICS: 13.220.20

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Committee representation

The Fire Safety and Prevention Industry Standards Committee (ISC M) under whose supervision this Malaysian Standard was developed, comprises representatives from the following organisations:

Association of Consulting Engineers Malaysia
Chemistry Department Malaysia
Construction Industry Development Board Malaysia
Consumers Association of Terengganu
Department of Standards Malaysia
Forest Research Institute of Malaysia
Jabatan Bomba dan Penyelamat Malaysia
Jabatan Kerja Raya
General Insurance Association of Malaysia
Housing Developers Association of Malaysia
Malaysian Fire Protection Association
Master Builders Association of Malaysia
Pertubuhan Akitek Malaysia
The Institution of Engineers, Malaysia
The Institution of Fire Engineers (UK) Malaysia Branch

The Technical Committee on Clean Agent Fire Extinguishing System, which developed this Malaysian Standard consists of representatives from the following organisations:

Erif Electronics Sdn Bhd
Federation of Manufacturing, Malaysia
Jabatan Bomba dan Penyelamat Malaysia
Jabatan Kerja Raya
General Insurance Association of Malaysia
Kolling Engineering Sdn Bhd
Malaysian Fire Protection Association
SIRIM Berhad (Secretariat)
SIRIM QAS Sdn Bhd (Fire Engineering Testing Section)
The Institution of Engineers, Malaysia
The Institution of Fire Engineers (UK) Malaysia Branch
Universiti Putra Malaysia

The Working Group on Portable Fire Extinguisher comprising the following members was set up by the Technical Committee to assist with the preparation of this Malaysian Standard:

Eversafe Extinguisher Sdn Bhd

Federal Iron Works Sdn Bhd

Fire Fighter (M) Sdn Bhd

Fitters Fire Technology Sdn Bhd

Flammart Sdn Bhd

Jabatan Bomba dan Penyelamat Malaysia

SIRIM Berhad (Secretariat)

SIRIM QAS Sdn Bhd (Product Certification Unit)

SIRIM QAS Sdn Bhd (Fire Engineering Testing Section)

Steel Ricon Industries Sdn Bhd

The Institution of Fire Engineers (UK) Malaysia Branch

Universiti Putra Malaysia

FOREWORD

This Malaysian Standard was developed by Working Group on Portable Fire Extinguisher established under the authority of the Fire Safety and Prevention Industry Standards Committee.

This standard is the first revision of MS 566: Part 3:1978, Code of practice for fire fighting installations and equipment – Part 3: Portable fire extinguisher and in the process new MS number, MS 1539 has been assigned.

During the development of this standard, reference was made to following:

1. BS 5306-8:2000 Fire extinguishing installations and equipment on premises – Part 8: Selection and installation of portable fire extinguisher – Code of practice

2. MS 1471 – Part 1:1999 Vocabulary on fire protection – Part 1: General terms and phenomena of fire

MS 1539 consists of the following parts, under the general title, 'Specification for portable fire extinguishers':

Part 1: Construction and test methodology

Part 2: Specification for wheeled fire extinguishers*

Part 3: Selection and installation – Code of practice

Part 4: Inspection and maintenance – code of practice*

Part 5: Portable fire extinguisher for use on cooking oil fires (Class F)*

Part 6: Specification for small, disposable and non-refillable fire extinguisher*

Part 7: Portable fire extinguisher for vehicles*

This Malaysian Standard is to emphasise the importance for the fire protection of a building to be considered as a whole. Portable fire extinguishers form only part, although an important part, of such facilities, and it should not be assumed that their provision entirely obviates the need for other protection, e.g. internal rising main, hose reels, sprinklers, fire blankets or other automatic or manual extinguishing systems, or trolley mounted or large mobile extinguishing units. 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.

NOTE. * These Malaysian Standards are still under development.

Because of the need to consider the total fire protection of a building, this code of practice assumes that a fire risk assessment has first been carried out on the premises and that the locations, types and consequences of possible fires have been identified. The recommendations of this code of practice are intended to assist the person responsible for the safety of the building in planning to control the consequences of the possible fires. It is important to note that the performance of this risk assessment is part of the duty of care legally required of a person having control of a workplace.

Advice on such matters can always be obtained from fire authorities, the Health and Safety Executive and fire insurers. Many fire safety consultants and fire engineering companies also offer this service. In addition reference should be made as necessary to other parts of this standard.

The application of this code of practice to the needs of small private dwellings was earlier considered but it was concluded that, whereas the general principles of the code are applicable to all buildings, there are considerations of scale and economics in small private dwellings that take it unrealistic to regard the code's recommendations as applying strictly to such premises.

The recommendations for inspection, maintenance and testing in this standard may be applied to portable extinguishers wherever they may be located.

It should be realised that the usefulness of portable fire extinguishers depends to a considerable extent on the presence of persons who know how to operate them, and staff should be trained in their use. Particular attention is drawn to the necessity for compliance with statutory requirements and to the necessity for observance of contractual obligations to insurers.

This Malaysian Standard cancels and replaces MS 566: Part 3:1978, Code of practice for fire fighting installations and equipment Part 3: Portable fire extinguisher.

Compliance with a Malaysian Standard does not of itself confer immunity from legal obligations.

SPECIFICATION FOR PORTABLE FIRE EXTINGUISHERS – PART 3: SELECTION AND INSTALLATION – CODE OF PRACTICE (FIRST REVISION)

1. Scope

This Malaysian Standard gives requirements on the suitability and siting of portable fire extinguishers, primarily those conforming to MS 1539: Part 1, that can be carried by one person and that are used for the protection of buildings and other premises and their contents.

This code of practice does not give detailed recommendations for small private dwellings. The selection and location of portable fire extinguishers in aircraft, caravans and marine craft are also excluded.

2. Referenced documents

The following referenced documents contain provisions which, through reference in this text, constitute provisions of this Malaysia Standard. For dated references, where there are subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Malaysia Standard are encouraged to investigate the possibility of applying the most recent editions of referenced documents. For undated references, the latest edition of the publication referred to applies.

BS 7937 Specification for portable fire extinguishers for use on cooking oil (Class F)

MS 981 Specification for safety signs and colours: Colour and design

MS 1182 Classification of fires

MS 1539: Part 1 Specification for portable fire extinguishers – Part 1: Construction and test methodology

MS 1539: Part 4 Specification for portable fire extinguishers – Part 4: Inspection and maintenance – code of practice

3. Definitions

For the purposes of this Malaysian Standard, the following shall apply.

3.1 Charge of a fire extinguisher

Mass or volume of the extinguishing medium contained in the extinguisher.

NOTE. The charge of appliances based on water is expressed in volume (litres) and that of other appliances in mass (kilograms).

3.2 Chemical foam fire extinguisher

Extinguisher from which foam is expelled when chemical solutions stored separately within the body of the portable fire extinguisher are allowed to mix and react on the actuation of the operating mechanism.

3.3 Clean agent

Electrically non-conducting, volatile or gaseous, fire extinguishing medium that does not leave a residue upon evaporation (referred to 5.5).

3.4 Extinguishing medium

Substance contained in the portable fire extinguisher, which causes extinction.

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 may be stored in the body or produced by the release of an auxiliary gas.

3.6 Fire risk assessment

The overall process of:

a) identification of possible sources of fire;

b) estimation of their probabilities;

c) evaluation of their consequences; and

d) comparison of the resultant risk estimate with predefined action criteria.

3.7 Flash-spread

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

3.8 Portable fire extinguisher

An 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.

3.9 Soda acid fire extinguisher

Extinguisher from which water is expelled by pressure resulting from an acid and/or alkali reaction in the contents of the portable fire extinguisher on the actuation of the operating mechanism.

3.10 Supplier

Party that is responsible for the product, process or service and is able to ensure that quality assurance is exercised.

NOTE. The definition shall apply to manufacturers, distributors, importers, assemblers, service organisations, etc.

3.11 User

Person or persons responsible for or having effective control over fire safety provisions adopted in or appropriate to the premises or building or risk where the portable fire extinguisher is installed.

4. General considerations

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 receive consideration 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 conclusions of this study should be used to decide upon the provision of portable fire extinguishers, which will be needed. There may be legislation, regulations or other conditions, which apply. Fire authorities, the Health and Safety Executive and fire insurers should be consulted for advice at this stage.

4.2 Erection and demolition of buildings

Consideration should also be given to the provision of extinguishers:

a) during the erection of a building, particularly where material or equipment is stored pending use or installation;

b) when a building is unused or in process of demolition; and

c) where any part of a building is brought into occupation prior to completion.

4.3 Availability of trained operators

Extinguishers are useful only where people are present who are prepared and able to use them. Therefore every opportunity should be taken to instruct personnel in their use, and to demonstrate their performance. A convenient opportunity for this occurs where extinguishers are discharged in accordance with the recommendations of MS 1539: Part 4.

4.4 Avoidance of multiplicity of types

To avoid confusion, all extinguishers installed in any one floor 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. These precautions apply equally to temporary replacement units supplied during maintenance operations (see MS 1539: Part 4).

4.5 Extinguisher types

Extinguishers conforming to MS 1539: Part 1, range from approximately 1 kg to 20 kg in total weight, 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, provided always that the extinguisher rating recommended in Clause 6 is satisfied. The rating system compares extinguishers by their ability to extinguish different sizes and types of fire.

4.6 Extinguisher colour coding

The colour coding of all portable extinguishers in a new installation should conform to the recommendation MS 1539: Part 1. This specifies the size of the colour coded area.

5. Suitability of extinguishers for various classes of fire

5.1 Classes of fire

5.1.1 Portable fire extinguishers should be provided for dealing with any potential classes of fire identified in the risk assessment. The suitability of extinguishers for dealing with the different classes of fire defined in MS 1182 is indicated by a letter and a pictogram marked on the extinguisher in accordance with MS 1539: Part 1.

5.1.2 The classes defined in MS 1182 are as follows:

a) 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).

b) Class B: Fires involving liquids or liquefiable solids.

c) Class C: Fires involving gases.

d) Class D: Fires involving metals.

5.1.3 For the purposes of this standard two additional classes are identified. These are:

e) Class E: Fires involving electrical equipment.

f) Class F: Fires involving fats and cooking oils

5.1.4 The A and B 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 6.1.

5.2 Special precautions for class C and D fires

5.2.1 It is not desirable to encourage untrained personnel to tackle classes C and D fires. However, where there are trained private brigades or personnel trained in the use of gas appliances or in handling of combustible metals, such as magnesium, special consideration should be given to the provision of extinguishers.

5.2.2 In the event of a leakage of gas becoming ignited, it should be extinguished only by closing the valve or plugging the leak. If, however, it is unsafe to approach the container, no attempt should be made to extinguish the flame in any other way.

5.2.3 Specifically formulated powder extinguishers are available for fires involving combustible metals but special application systems and techniques may be needed. There are no quantitative parameters for rating class D fires. The type of combustible metal and the area, depth and other characteristics of the fire, which may be controlled and extinguished by particular extinguishers should be established from the manufacturer's literature.

5.2.4 The siting of extinguishers should be selected with the aid of the manufacturer's installation instructions. Fires involving metals can be complicated by the presence of flammable liquids such as cutting lubricants or by the metal itself melting. Traditional remedies such as sand buckets can be effective provided that the sand is clean and dry. Several of the types of extinguishers mentioned in this code can cause dangerous conditions when used on class D fires. Control Of Substances Hazardous to Health (COSHH) and Use and Standards of Exposure of Chemical Hazardous to Health (USECHH) data sheets can provide a source of information if the probable materials are known.

5.2.5 Advice on these matters may be obtained from the fire authorities, the Health and Safety Executive, fire consultants or fire insurers; many fire engineering companies also offer this service.

5.3 Fires involving electrical equipment

5.3.1 Only extinguishers marked, as being suitable for dealing with fires in electrical equipment should be sited close to such apparatus.

NOTE. Water and foam extinguishers manufactured in accordance with MS 1539: Part 1 were not required to be marked if they passed the test of MS 1539: Part 1. They were required to be marked if they failed the test or were not submitted. There will still be extinguishers that have this marking. The above recommendation refers to extinguishers manufactured to MS 1539: Part 1. Where there is uncertainty, guidance should be sought from the manufacturer.

5.3.2 The use of carbon dioxide, clean agent or powder extinguishers on live electrical equipment does not increase the danger of electric shock from the equipment but, because aqueous solutions are electrically conductive, the use of water and foam extinguishers can do so. The danger 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.

5.3.3 Water and foam extinguishers that do not meet the requirements of the dielectric test of MS 1539: Part 1 is marked "DO NOT USE ON LIVE ELECTRICAL EQUIPMENT". However, for many years extinguishers of these types have of necessity been installed and used in premises in general where electric lighting fittings and power socket outlets are present. This use is acceptable subject to the limitation given above. Water and foam extinguishers that meet the requirements of the dielectric test of MS 1539: Part 1 reduces the danger of conduction along the discharge stream but not that of conduction along wetted surfaces. Where class A or class B fire risks in the close proximity of live electrical equipment are to be covered by portable fire extinguishers, water or foam extinguishers of these types may in some circumstances be preferred or be more suitable than carbon dioxide, clean agent or powder extinguishers. They should be installed only where the circumstances are not such that wetted surfaces or pools of the discharged medium may conduct electric current to the operator or other persons.

5.3.4 Water or foam extinguishers that meet the requirements of the dielectric test of MS 1539: Part 1 should not be installed for direct use on live electrical equipment except after specific consultation with the manufacturers of the extinguishers, the manufacturers of the electrical equipment and the fire authority.

5.4 Fires involving fats and cooking oils, class F fires

5.4.1 Extinguishers for these fires should be classified in accordance with BS 7937, though these extinguishers may also be suitable for use on other fire classes.

5.4.2 One hazard is the splashing of the liquid fire caused by the jet from the extinguisher. In addition some water may penetrate the fire zone and there vapourise, increasing the volume of the burning plume. Further, if any drops reach the surface of the liquid container their higher density will cause them to sink into the burning liquid. If this occurs the water will suddenly boil into steam within the hot body of the liquid. This expansion can throw flaming droplets into the air and onto nearby surfaces. A major expansion of the area of the fire and acceleration of its development will probably result.

5.4.3 The selection of extinguishers should also take into account the likelihood of gaseous and/or electrical hazards in the same area. Multi-purpose types are especially suited to these positions. For deep fat frying situations class F extinguishers are recommended.

NOTE. It is most important that extinguishers using a plain water jet as the extinguishing medium should not be used on oil or fat fires.

5.5 Gaseous extinguishing agents

5.5.1 Three groups of gaseous extinguishing agents may be used in portable extinguishers. The first is the halons, the use of which has been greatly restricted by the ratification of the Montreal Protocol. The second is carbon dioxide and the third group consists of more complex mixtures of non-halogen gases. All of these groups are classified as clean agents.

5.5.2 All three groups and possibly decomposition products are likely to be hazardous to persons in enclosed spaces with restricted ventilation. Such extinguishers cause little hazard when used in the open air, large rooms and other well ventilated places inside buildings.

5.5.3 The use of halon fire extinguishers should be strictly limited. Other clean agents should be used in preference. The only significant uses permitted for halon extinguishers would be essential uses for example aircraft, military and/or for special police purposes.

5.5.4 All import of clean agent extinguishing medium shall have the approval from the Department of Environment. Clean agent fire extinguishers shall comply with the requirements set forth by the Fire and Rescue Department of Malaysia with the current approval certificate.

6. Distribution of extinguishers according to fire classification and rating of extinguisher

6.1 General

6.1.1 The scheme of classification and rating given in MS 1539: Part 1 makes it possible to specify the distribution of extinguishers in buildings according to extinguishing capability rather than by extinguisher type and size or content.

6.1.2 According to this scheme, 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 MS 1539: Part 1. For example, an extinguisher marked “8A" is capable of extinguishing a class A test fire of size 8A, and an extinguisher marked "13A" is capable of extinguishing a class A test fire of size 13A. Similarly an extinguisher marked "55B" is capable of extinguishing a class B test fire of size 55B. Extinguishers with both class A and class B capability are marked accordingly, e.g. "13A/55B". A more detailed explanation is given in Appendix A.

6.2 Class A fires in carbonaceous solids

6.2.1 Class A materials are generally present in all premises and occupancies. The basic scale of provision of extinguishers where these are the only primary first aid means of fire defence is that, on each storey, there should be at least two extinguishers sited in accordance with the provisions of Clause 7. Where, as a result of a risk assessment, it is determined portable fire-fighting equipment should be installed, the lowest level of provision likely to provide a realistic level of protection can be calculated by the total class A rating of all extinguishers on that storey. This should be not less than 0.065 x floor area of storey (in m^2) and should not be less than 26A (see note). This requirement corresponds to a floor area of 400 m^2. However, in the case of buildings in single occupancy with upper floor area not exceeding 100 m^2 the minimum aggregate rating required for these floors is 13A (see example in Appendix B).

6.2.2 The particular selection should be made according to the circumstances, the arrangement of the building, and the recommendations of 4.4, 4.6, 6.4 and Clause 7.

6.2.3 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.

6.2.4 The extinguishing tests of MS 1539: Part 1 are made under draught-free conditions. Class A fires are more difficult to extinguish, and more liable to reignite, outdoors or indoors where there are air currents. Under such conditions the performance of gaseous extinguishers is more affected than powder, water or foam.

6.2.5 The discharge of a powder extinguisher in a confined space can cause a sudden reduction of visibility which may temporarily jeopardise escape, rescue or other emergency actions. For this reason water-based extinguishers are to be preferred in hospitals, old people's homes and hotels. Except in very unusual circumstances it is undesirable to choose to provide a pair of extinguishers of the highest rating or a large number of very lowly rated extinguishers to make up the minimum aggregate needed. For example, it would normally be undesirable to meet a 104A rating by providing two extinguishers of 55A rating. The combinations offered in example Clause C1 would provide better solutions.

6.2.6 This basic scale is applicable to a wide range of occupancies, but additional extinguishers should be provided at locations where the likelihood of fire is above average, or where a fire would be particularly intense. These cases can be identified if a full risk assessment is carried out. If necessary expert advice should be sought, for instance from the fire authorities or fire insurers. Many fire safety consultants and fire engineering companies also offer such advice.

NOTES:

1. It is recommended that gaseous extinguishers are not installed in any area as the only type of extinguisher for class A fires.

2. The requirements for class A fires are similar to previously accepted practice. The assumption is made that a 9 L (2 gallon) water extinguisher can achieve a 13A rating.

6.3 Class B fires involving flammable liquids

6.3.1 General

6.3.1.1 Table 1 gives recommended minimum ratings for the selection of extinguishers for class B fires. The derivation of these recommendations is explained in Appendix C and their application is described in 6.3.2 to 6.3.4. Examples are given in Appendix B. It should be remembered that different types of extinguishers, of the same rating, have different characteristics which, in particular circumstances, may make one type preferable to another. Mass for mass, powders are probably the most effective medium against class B fires but they are not effective against fires in which part of the fuel surface is shielded from the powder discharge. Reignition of the fuel is possible once the powder discharge ceases; it is not possible to partially extinguish the fire. This applies also to gaseous extinguishers.

6.3.1.2 Foam is not effective against "running" fires, but 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 are required for use against water miscible liquids or some types of solvent.

6.3.1.3 Where both foam and dry powder extinguishers are installed, care should be taken to ensure compatibility of use. Tests on the smaller class B fires described in MS 1539: Part 1 may be carried out indoors but those on the larger fires are usually carried out outdoors, with a maximum wind speed of 3 m/s. The extinguishing medium may be dispersed by strong winds and thus make extinguishing more difficult. Class B fires are also more difficult to extinguish in still air conditions.

6.3.2 Grouping of class B fire risks

6.3.2.1 In order to determine the minimum recommended provision of suitable extinguishers it is convenient to assess premises in the following manner.

a) Each room or enclosure should be considered separately.

b) Fire risks more than 20 m apart should be considered separately.

c) Fire risks sited within 20 m of another fire risk should be assessed either as undivided groups (see 6.3.3.2) or as divided groups (see 6.3.3.3).

6.3.2.2 Extinguishers should be sited as close as possible to the anticipated point of occurrence (see 7.4). It is undesirable to cover dispersed risks with the same extinguisher(s), with consequent excessive travel distances to reach the fire with an extinguisher. The distance apart of 20 m has been selected as reasonable in view of the danger of rapid spread inherent in class B fires.

6.3.3 Contained fires

6.3.3.1 Single open topped containers

The minimum class B rating of an extinguisher or extinguishers recommended for a single open-topped container of flammable liquid (e.g. mixing vessel, dip tank, spillage in bunded area) can be read directly from Table 1. The surface area of the container is used to determine the rating (see examples in Clause B2).

Table 1. Maximum area of class B fire (deep liquid) for which extinguishers are suitable

Extinguisher rating	Maximum area for three extinguishers (foam extinguishers only) (m^2)	Maximum area for two extinguishers (m^2)	Maximum area for one extinguisher (m^2)
21B	0.42	0.26	0.14
34B	0.68	0.42	0.23
55B	1.10	0.69	0.37
70B	1.40	0.88	0.47
89B	1.78	1.11	0.59
113B	2.26	1.41	0.75
144B	2.88	1.80	0.96
183B	3.66	2.29	1.22
233B	4.66	2.91	1.55

6.3.3.2 Undivided group of containers

Containers less than 2 m apart should be considered as an undivided group, as equivalent to a single container. The total surface area of all 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 (see example B2.2).

6.3.3.3 Divided group of containers

Containers more than 2 m, but less than 20 m apart should be considered as forming a divided group. The surface area of the largest container (or aggregate surface area of the largest undivided group) or one-third of the aggregate surface area of all the containers in the group, whichever is the greater, is used to determine the recommended rating. The minimum class B rating recommended can be read from Table 1 using this value (see example B2.2).

6.3.3.4 Spillage

The recommended minimum rating of extinguisher to cover spillage of flammable liquid is calculated from the anticipated volume of spillage as follows:

Recommended minimum rating = 10 x volume (in L) of spillage

The derivation of this formula is given in Clause C4 and an example of its use is given in B2.3. The volume of spillage should be assessed according to the particular circumstances. In the case of non-spillproof movable containers it should be assumed that the whole contents of the largest movable container may spill. Large volume spillage into restricted areas such as bunds, silled rooms and gullies should not be assessed by the formula given in this clause, but should be regarded as a container fire of area equal to that of the restricted area.

6.3.4 Additional provision of extinguishers

It should be borne in mind that the recommendations given in Table 1 are minimum and are intended to cover the more common flammable liquids. Where liquids have a low fire point or are especially difficult to extinguish, such as diethyl ether and carbon disulfide, 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 range of the fixed equipment. Similarly, 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. These additional extinguishers should be selected according to the recommendations given in Table 1.

6.4 Mixed ratings

Where both class A and class B materials are present in the same area extinguishers should be provided to meet the recommendations of 6.2 and 6.3 (see Clause B6).

NOTE. The installation of a single type of extinguisher with both class A and class B ratings is recommended in preference to two types, one class A the other class B, taking note of the limitations of the various types given in 6.2 and 6.3.1.

6.5 Class C fires involving gases

6.5.1 Extinguisher type

For fires involving gases, powder types of extinguishers should be used but no special formulation will be needed. Other types of extinguishers should not be sited in areas where gas leakage is the major factor in the risk analysis. The size of extinguisher is not critical as even the smallest can extinguish a 7 mm leak in a high-pressure gas line. In these circumstances the flame might be some 13 m long, but even powder extinguishers will not prevent re-ignition of a continuing leak. No attempt should be made by any person except a trained fire fighter to use any extinguisher provided.

6.5.2 Stopping fuel flow

If a trained fire fighter is not at the scene of the incident the only possible method of extinguishing these fires is to cut off the flow of fuel to the leaking container, as advised in 5.2. If this can not be done immediately, two opposing hazards are possibilities. These are the jet of flame contrasted with 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, allowing the flame to continue is the least dangerous option until the flow can be stopped. 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.

6.5.3 Travel distance

The siting of gas control valves and extinguishers should therefore be considered with respect to the recommendations on travel distance contained in 7.3. This will be the controlling factor for the provision of extinguishers for gas systems.

6.6 Class D fires of combustible metals

No general recommendations can be made for the provision of extinguishers to protect against these specialised hazards. Decisions should be made on a case by case basis with expert advice. The use of inappropriate equipment can make an accident worse.

6.7 Class E fires involving electrical equipment

6.7.1 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 risks in the area The class A recommendations are likely to be applicable in most cases. All extinguishers to be sited near any electrical equipment, which might be involved in a fire, should be of a type, which is marked as suitable for use on electrical fires.

6.7.2 The first step in approaching the fire should be to cut off the power to the equipment at the seat of the fire and to any other that might be affected.

6.8 Class F fires involving fats and cooking oils

6.8.1 For these fires the first action should be to cut off the power input to the cooking container, if this can be done in safety.

6.8.2 Portable extinguishers for emergency attack on cooking fires should be selected in accordance with Table 2. These sizes have been derived from an aerating factor applied to the test fire sizes as is done in Appendix C. These sizes allow a margin of extinguishing capacity to ensure that inexperienced people can fully extinguish these fires. For certain types of extinguishing medium this may mean that there is a risk of the cooking container overflowing. If this appears likely to occur, the excess medium should be directed away from the cooking container once the fire is completely extinguished. However it should be borne in mind that other means exist for extinguishing these fires.

6.8.3 Many cooking arrangements may restrict access to a fire by extinguishers. Examples are cooking tunnels for fume extraction, which only allow end access, or ranges set against a back wall. The use of more than two extinguishers are therefore not advised. If areas greater than those shown in the table need protection the provision of a fixed extinguishing system will be required.

6.8.4 It is probable that there will be mixed hazards in kitchens. It is therefore advisable to specify portable extinguishers for the cooking hazard which are capable of extinguishing class A fires in addition to class F. In such a case the sizes of the extinguishers should be decided by the larger of the class A and class F requirements.

6.8.5 As stated in 5.4, extinguishers using plain water should not be placed in kitchens. Not only may they increase the fire hazard by the mechanisms described above, but it is very likely that there will be electrical implements in use in the area, often on metallic work surfaces in commercial scale facilities. The use of these types of extinguishers could therefore add electrical dangers to the fire situation.

6.9 Provision of replacement extinguishers

Sufficient spare extinguishers should be available so those discharged extinguishers may be recharged or replaced immediately after use.

Table 2. Maximum area of class F fire (cooking oil) for which extinguishers are suitable

Extinguisher rating	Maximum area for two extinguishers m^2	Maximum area for one extinguisher m^2
5F	0.06	0.015
15F	0.08	0.02
25F	0.13	0.04
75F + 15F	0.24	-
75F + 25F	0.27	-
75F	0.40	0.11
NOTE. For fire rating and quantity of agent for class F extinguisher, refer to Table 3 of BS 7937.		

7. Siting of extinguishers

7.1 Location

7.1.1 Normally, extinguishers should be located in conspicuous positions on brackets or stands where they will be readily seen by persons following an escape route. Siting positions near to room exits, corridors, stairways, lobbies and landings are most suitable. Extinguishers should not be located where a potential fire might prevent access to them.

7.1.2 Where it is required by the Department of Occupational Safety and Health and the Fire and Rescue Department, attention should be drawn to the position of extinguishers where necessary by fire safety signs as specified in MS 981, and the user should keep a record (conveniently on a plan) of the type, number and location of the extinguishers.

7.2 Mounting

Small extinguishers with a total weight up to and including 4 kg should be mounted so as to position the handle about 1.5 m from the floor but the carrying handle of larger, heavier extinguishers should be about 1 m from the floor. Care should be taken to ensure that a heavy extinguisher does not itself cause injuries by being dislodged and falling onto limbs or bodies. Extinguishers installed under conditions where they are subject to dislodgement should be installed in specifically designed brackets. Extinguishers sited in schools require extra thought to avoid such accidents and the use of recessed housings should be considered. Any mounting bracket used should conform to MS 1539: Part 1, see 3.2.

7.3 Accessibility

Extinguishers should be available for immediate use at all times. Extinguishers should be sited in such a way that it is not necessary to travel more than 20 m from the site of the fire to reach an extinguisher. Similar positions on each floor are advisable. It is inadvisable to place extinguishers in positions in rooms or corridors away from exits unless they are necessary to cover a particular hazard. Extinguishers should not be placed in concealed positions behind doors, in cupboards or deep recesses, or in positions where they might cause obstruction to exit routes or be damaged by trolleys, nor should they be placed over or close to heating appliances. If for any reason extinguishers are placed in positions covered from direct view their position should be indicated by suitable signs.

7.4 Proximity to special fire risks

Extinguishers provided to deal with special fire risks should be sited near to the fire risk concerned, but not so near as to be inaccessible or place the operator in undue danger in case of fire.

NOTE. If the fire risk is in a confined space, it is generally advisable to position the extinguisher immediately outside that space.

7.5 Avoidance of exposure to excessive heat and cold

The operation of extinguishers is affected by temperature and those conforming to MS 1539: Part 1 are therefore marked with the temperature range within which they will perform satisfactorily. Extinguishers should not be exposed to storage temperatures outside the range marked on the extinguisher.

7.6 Avoidance of corrosion

Extinguishers, unless specially treated by the manufacturer, specially housed in purpose designed boxes, or provided with protective covers designed for the purpose, should not be located in places where they may be exposed to unduly corrosive atmospheres or to splashing by corrosive fluids. When it is impossible to follow the recommendations given in 7.1 and an extinguisher has unavoidably to be kept on ground or floor level in conditions where dampness may cause corrosion, such extinguishers should be of the free-standing type conforming to MS 1539: Part 1.

Appendix A
(informative)

System of rating extinguishers by fire tests in MS 1539: Part 1

A1. Class A rating

A1.1 MS 1539: Part 1 provides for a series of prescribed wood crib test fires. The wooden cribs are of standard cross-section 0.5 m wide x 0.56 m high but have varying length. An extinguisher is given a class A (see 5.1.2) rating corresponding to the largest standard wood crib test fire that has been extinguished with it, following the test procedure.

A1.2 The lengths of the standard test fires and the corresponding extinguisher ratings are as given in Table A1.

Table A1. Dimensions of class A test fires

Length of standard test fire (m)	Designation of test fire and extinguisher rating
0.5	5A
0.8	8A
1.3	13A
2.1	21A
2.7	27A
3.4	34A
4.3	43A
5.5	55A

A2. Class B rating

For class B fires (see 5.1.2) the rating denotes the largest flammable liquid tray fire that can be extinguished with the extinguisher following the procedure specified. The numerical value of ratings corresponds to the volume of liquid (in L) contained in the tray. Class B ratings are shown in Table 1.

Appendix B
(informative)

Examples in the application of the recommendations for minimum provision of extinguishers

B1. Minimum provision for class A fires

Example 1

For a single storey building of floor area 1 600 m^2 the minimum aggregate class A rating (see 6.2) is:

0.065 x 1 600 = 104A

This aggregate rating can be provided in one of a number of ways. For example:

8 x 13A extinguishers = 104A
2 x 27A + 7 x 8A extinguishers = 110A
4 x 27A extinguishers = 108A
3 x 43A extinguishers = 129A
1 x 43A + 5 x 13A extinguishers = 108A

NOTE. The travel distance for any point on the floor to the nearest extinguisher should not exceed 20 m (see 7.3). This may mean that extinguishers additional to this minimum need to be installed.

B2. Minimum provision for class B fires

B2.1 Example 2. Single containers

B2.1.1 Case 1

A single dip tank of surface area 1.0 m^2 is situated in a room. The recommended minimum rating is found from Table 1 as follows:

a) if only one extinguisher is to be installed, 183B (from columns 4 and 1);

b) if two extinguishers (foam only) are to be installed, 89B each (from columns 3 and 1); and

c) if three extinguishers (foam only) are to be installed, 55B each (from columns 2 and 1).

B2.1.2 Case 2

A vessel containing a maximum of 200 L of flammable liquid is positioned within a bund 1.3 m x 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 x 1.9 = 2.47 m^2.

a) if two extinguishers (foam only) are to be installed, 233B each (from columns 3 and 1); and

b) if three extinguishers (foam only) are to be installed, 144B each (from columns 2 and 1).

B2.2 Example 3. Group of containers

B2.2.1 Six open tanks are sited in a room, with spacing and surface areas as given in Table B1.

Table B1. Tank arrangement in Example 3

Tank no.	Surface area (m^2)	Distance from nearest tank (m)
1	2.0	25 (no. 2)
2	1.3	2.5 (no. 3)
3	0.6	1.6 (no. 4)
4	0.6	1.5 (no. 3)
5	0.4	1.5 (no. 4)
6	1.2	12.5 (no. 5)

B2.2.2 Tank no. 1 is more than 20 m from the nearest tank and is therefore assessed separately (see 6.3.3.1).

The area of the tank is 2.0 m^2 and the recommended minimum rating is found from Table 1 as follows:

a) if two extinguishers (one foam) are to be installed, 183B each (from columns 3 and 1); and

b) if three extinguishes (foam only) are to be installed, 113B each (from columns 2 and 1).

B2.2.3 The remaining tanks form a divided group, in which the largest tank has an area of 1.3 m^2 and tanks 3, 4 and 5 form an undivided group of aggregate area 1.6 m^2.

The total surface area of the five tanks in the divided group is 4.1 m^2. One-third of this area is 1.37 m^2, more than the area (1.3 m^2) of the largest single container but less than the aggregate area (1.6 m^2) of the largest undivided group. The largest of the three values (1.6 m^2) is used with Table 1 to find the recommended minimum rating as follows:

a) if two extinguishes (one foam) are to be installed, 144B each (from columns 3 and 1); and

b) if three extinguishes (foam only) are to be installed, 89B each (from columns 2 and 1).

B2.2.4 A summary of the minimum provision recommended for this room as determined in C2.2.2 and C2.2.3 is:

either

for tank no. 1	2 x 183B one foam extinguisher
for the remainder	2 x 144B one foam extinguisher

or

for tank no. 1	3 x 113B foam extinguishers
for the remainder	3 x 89B only

If both powder and foam extinguishers are to be provided within the room, it is imperative that they are compatible.

B2.2.5 It is often convenient to reduce to a minimum the number of different types of extinguisher. In the case of this example this can be achieved by installing:

for tank no. 1	2 x 183B one foam extinguisher
for the remainder	2 x 183B one foam extinguisher

or

for tank no. 1	3 x 113B foam extinguishers
for the remainder	3 x 113B only

or

for tank no. 1	3 x 144B foam extinguishers
for the remainder	2 x 144B only

In the last case one fewer extinguisher, but of a higher rating, meets the recommendations, compared with C2.2.4.

B2.3 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 x 5 = 50 (i.e. 55B; any type except foam)

The extinguishers specified in Example 3 will meet the recommendation provided they are sited not more than 20 m from the anticipated spill. If this condition cannot be met, additional extinguishers rated not less than 55B (of any type except foam) are recommended to be installed at intervals of not more than 40 m (2 x 20 m) throughout the area at risk. The extinguishers provided in Example 2 are recommended for volumes of spillage up to 18.3 L or 37.7 L depending on the choice made. If spillages are anticipated in excess of either of these volumes, as appropriate, then extinguishers of higher rating may need to be installed according to the recommendation of 6.3.3.4.

B3. Example 5, minimum provision for class C fires

A gas pipe is running outdoors on a factory site with no combustible materials within 20 m of the pipe at any point along its run. No fire extinguishers need be provided to cover this hazard, but it is advisable that control valves be arranged to isolate the run into 60 m (2 x 30 m) sections. These lengths can be increased if staff working in the area can communicate rapidly with those responsible for controlling the fuel flow.

B4. Example 6, minimum provision for fires involving electrical equipment

For fires in the vicinity of electrical equipment the fire loading will be determined by the class A or class B hazards in the area. In general, then, the provision of extinguishers will be decided by similar criteria to those for those classes. For example, assume that an arts classroom 20 m by 20 m containing an electrically powered pottery kiln is sited in a single storey block containing three other similarly sized rooms. The minimum provision of extinguishers can be based upon the total floor area of the block of 1 600 m^2. This gives a minimum total class A rating of 104A for the block, as shown in B.1, Example 1. At least one extinguisher of 27A rating and either meeting the dielectric test of MS 1539: Part 1 or being a powder should be provided adjacent to, or inside, the door of the arts room. All of the classrooms can then be protected by:

for the kiln	1 x 27A
for all the rooms	1 x 43A + 1 X 34A

or

for the kiln	1 x 27A
for all the rooms	3 x 27A

or

for the kiln 1 x 27A
for all the rooms 6 x 13A

but other combinations are possible. In practice this case may be covered most simply by using the second solution with all the extinguishers in the block being suitable for use near electrical equipment.

B5. Example 7, minimum provision for class F (cooking oil) fires

B5.1 Case 1

A domestic kitchen is used to cook chips in a pan of 21 cm diameter. The area of this is approximately 0.035 m^2.

From Table 2 two possibilities can be seen which will offer sufficient protection against the chip pan fire alone:

2 x 5F rated extinguishers

or

1 x 25F rated extinguisher

In this case the advice could be to provide the single larger extinguisher because of the inexperienced nature of the likely users. As noted in 6.8 the provision of a fire blanket to BS EN 1869 might also be considered.

B5.2 Case 2

A canteen kitchen contains a deep fryer containing 20 L of oil. It is gas fired and the size of the oil bath is 0.4 m by 0.7 m. The area of the possible fire is therefore 0.28 m^2. This is just above the maximum size for a 75F and a 25F extinguisher combination so that the provision would be:

2 x 75F units

NOTE. A fire blanket conforming to BS 7499 could be used as an alternative.

B6. Example 8, combining extinguishers of different rating classes

If, in an area for which a class A rating of 55A is recommended, there is a class B fire risk for which the extinguishers recommended are one of the following:

a) one 89B extinguisher (any type); or

b) two 55B extinguishers (any type); or

c) three 34B extinguishers (foam only);

then extinguishers with dual ratings can contribute to the class A and class B recommendations. Thus for

a) one extinguisher rated 13A/89B the additional class A provision is 55 - 13 = 42A;

b) two extinguishers rated 13A/55B the additional class A provision is 55 - 2 x 13 = 29A; and

c) three extinguishers rated 13A/34B the additional class A provision is 55 - 3 x 13 = 16A;

and extinguishers of appropriate class A rating to meet only the additional class A requirement may be installed.

Appendix C
(informative)

The practical effectiveness of extinguishers and derivation of Table 1

C1. Basic relationship

There is a direct relationship between the class B rating of an extinguisher and the surface area of the corresponding MS 1539: Part 1 test fire, as shown in Table B1.

C2. Derating for inexperienced operators

C2.1 The test fires are dealt with under ideal conditions by an experienced and trained operator. However, in a real fire situation, the operator, although he or she should have received some instruction and training in the use of extinguishers, has to be regarded as of limited experience. Conditions will rarely be ideal and fire, even if anticipated, will be unexpected. In the real fire situation, therefore, it cannot be expected that an extinguisher will be capable of extinguishing a fire of equal area to the test fire.

C2.2 A derating factor of 2.5 is therefore applied; that is extinguishers are recommended as being suitable for extinguishing a real fire 2.5 times smaller than the rated test fire. This is considered adequate when two extinguishers are installed, but if only one is to be installed the factor to be applied is 4.7. For foam extinguishers only, the derating factor can be reduced to 1.57 but in this case three extinguishers would need to be installed. If two, or one, foam extinguisher(s) are to be used then the appropriate factors above apply.

C2.3 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 unskilled operators.

Table C1. Dimensions of class B test fires

Designation or test fire	Volume of test fuel (1/3 water + 2/3 fuel) (L)	Dimensions of tray			
		Approximate diameter (mm)	Depth (mm)	Thickness of walls (mm)	Approximate surface area (m^2)
21B	21	920	150	2.0	0.66
34B	34	1 170	150	2.5	1.07
55B	55	1 480	150	2.5	1.73
70B	70	1 670	150	2.5	2.20
89B	89	1 890	200	2.5	2.80
113B	113	2 130	200	2.5	3.55
144B	144	2 400	200	2.5	4.52
183B	183	2 710	200	2.5	5.75
233B	233	3 050	200	2.5	7.32
NOTE. For further details on volume of test fuel, refer to Table 12 of MS 1539: Part 1.					

C3. Separation of open-topped containers and the danger of flash-spread

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 risk. 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.

C4. Spillage

Fires involving spilled flammable liquids are of 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, silled rooms, gullies, etc.) is comparable to the case of a container of flammable liquid, and extinguishers need to be selected accordingly (see 6.3). 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 may be expected to spread to any depth up to a minimum of, say, 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 L, on the test fire is:

Class B rating

4

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

Class B rating

10

NOTE. Specially trained and experienced persons, particularly when working in groups and wearing protective clothing, can extinguish fires comparable to the MS 1539: Part 1 test fire for a particular extinguisher. In these circumstances an extinguisher is to be regarded not as a first-aid but as a specialised fire-fighting appliance. Recommendations for this type of application are not within the scope of this code.

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