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BRITISH STANDARD

Code of practice for the operation of fire protection measures –

Part 1: Electrical actuation of gaseous total flooding extinguishing systems

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iii, pages 1 to 10, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 7273 was published by BSI and came into effect on 28 July 2006. It was prepared by Subcommittee FSH/12/4, *Automatic operation of fire protection*, under the authority of Technical Committee FSH/12, *Fire detection and alarm systems*. A list of organizations represented on this committee can be obtained on request to its secretary.

The start and finish of text introduced or altered by Amendment No. 1 is indicated in the text by tags ▌A1⟩ ⟨A1▌.

Supersession

This part of BS 7273 supersedes BS 7273-1:2000, which is withdrawn.

Relationship with other publications

BS 7273 is published in a series of parts:

- Part 1: *Electrical actuation of gaseous total flooding extinguishing systems*;
- Part 2: *Mechanical actuation of gaseous total flooding and local application extinguishing systems*;
- Part 3: *Electrical actuation of pre-action sprinkler systems*.

Further parts of this standard either planned or in preparation will deal with the automatic closing (or opening) of fire doors, fire shutters, etc.

Information about this document

This is a full revision of BS 7273-1. The principal changes from the previous edition are as follows.

- Recommendations relating to control and indicating equipment have been removed. Reference is now made to BS EN 12094-1 and BS EN 54.
- Reference is made to BS ISO 14520.
- The recommendations relating to detector type and number needed for coincidence have been clarified.

Attention is drawn to Annex A, which gives a simple diagrammatic representation of a typical sequence of actions leading to the release of fire extinguishing gas.

Use of this document

As a code of practice, this part of BS 7273 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 British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Hazard warnings

CAUTION. Certain electromagnetic fields, such as those generated by radio transmitters, have been known to trigger electrically actuated gas release facilities or cause gaseous extinguishing systems to malfunction. Particular problems can occur if the system is installed in high field strengths such as at or near airports or radar transmitter stations. In such cases it is essential to avoid the risk of accidental discharge due to the electromagnetic field radiated by such apparatus. Specialist advice should be sought where necessary.

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.

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1 Scope

This part of BS 7273 gives recommendations for the design, installation and commissioning of electrical equipment for the actuation of gaseous total flooding fire extinguishing systems. It covers the interface between fire detection and fire alarm systems (see BS 5839-1) and gaseous total flooding fire extinguishing systems (see BS 5306 and BS ISO 14520) and is also applicable to fire protection systems for electronic equipment installations (see BS 6266).

NOTE Whilst the recommendations are applicable mainly to total flooding systems they may also be used for local application systems.

2 Normative references

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

BS 5306-4, *Fire extinguishing installations and equipment on premises – Part 4: Specification for carbon dioxide systems*

BS 5839-1:2002, *Fire detection and fire alarm systems for buildings – Part 1: Code of practice for design, installation, commissioning, and maintenance*

BS 6266, *Code of practice for fire protection for electronic equipment installations*

BS EN 54-2, *Fire detection and fire alarm systems – Part 2: Control and indicating equipment*

BS EN 54-4, *Fire detection and fire alarm systems – Part 4: Power supply equipment*

BS EN 12094-1, *Fixed firefighting systems – Components for gas extinguishing systems – Part 1: Requirements and test methods for electrical automatic control and delay devices*

BS EN 12094-3, *Fixed firefighting systems – Components for gas extinguishing systems – Part 3: Requirements and test methods for manual triggering and stop devices*

BS ISO 14520 (all parts), *Gaseous fire-extinguishing systems*

3 Terms and definitions

For the purposes of this part of BS 7273 the terms and definitions given in BS 5839-1, BS EN 12094-1 and the following apply.

3.1 automatic/manual and manual only mode switch
means of converting the system from automatic and manual to manual only actuation

NOTE This can be in the form of a manual switch on the e.c.d. or other units, or a personnel door interlock; in all cases, this changes the actuation mode of the system from automatic and manual to manual only or vice versa.

3.2 automatic
<of a fire extinguishing system> mode of operation in which the system can actuate without manual intervention

3.3 coincidence
arrangement designed so that an output is obtained only when at least two independent input triggering signals are present at the same time

NOTE For example, an output suitable for triggering a fire extinguishing system is obtained only after a detector has detected a fire, and at least one other independent detector covering the same protected space has confirmed the existence of fire.

3.4 electrical automatic control and delay device (e.c.d.)
device that carries out all processing of the functions necessary for the electrical control of a fire extinguishing system

NOTE The e.c.d. can be either a separate device or part of the control and indicating equipment (c.i.e.) of an automatic fire detection and fire alarm system.

3.5 manual
mode of operation in which the system can actuate only with manual intervention

3.6 protected space
space protected by a fire extinguishing system

3.7 stakeholder
party with an interest in the system

NOTE The interest might be:

- *financial, e.g. owner or insurance company;*
- *as a customer (internal or external);*
- *as an enforcing authority, e.g. building control officer, fire and rescue authority;*
- *in a professional capacity as an adviser to one of the parties, e.g. architect, fire engineer, building service engineer; or*
- *in a contractual capacity, e.g. a manufacturer, installer or maintainer of equipment.*

4 System design

4.1 General

The requirements for the protected space(s) should be ascertained by the designer, by means of consultation with the relevant stakeholders.

It is essential that, in the event of fire, a pre-planned and practised course of action is taken to ensure the safety of occupants and the effective operation of the fire extinguishing system. Such necessary actions should be discussed at the design stage and incorporated within the proposed system.

The system design should conform to the appropriate provisions of:

- BS 5839-1, for fire detection and fire alarm;
- BS 5306-4 and BS ISO 14520, for gaseous fire extinguishing.

On the basis of this consultation, the designer should prepare documents showing details of the design including, for example, a simple diagrammatic representation of a sequence of actions leading to the release of fire extinguishing gas (see Annex A for an example of a diagrammatic representation).

4.2 Operation of the system

Operation of the system should follow a sequence leading to the release of fire extinguishing gas (for example, see Annex A). This sequence should normally encompass coincidence in order to avoid unwanted discharges when in the automatic mode of operation.

Operation of the first detector should result in at least an indication of fire at the c.i.e. and the sounding of the fire alarm system within the protected space (see Annex A).

Confirmation of discharge of the fire extinguishing system ("released condition") should be indicated at the e.c.d. by means of a signal representing the flow of extinguishing gas. The method of deriving the signal should be a pressure or flow switch, located so as to indicate that discharge of gas has occurred from any storage container in the system. For example, in the case of a bank of containers the discharge of gas from any container into the central manifold should be indicated.

Interruption of the connection between the c.i.e. and any part of the e.c.d. should not affect the operation of any fire detector or sounding of the fire alarm system throughout the protected space.

4.3 Circuit design

4.3.1 Fire detection and fire alarm system

The fire detection and fire alarm system should be designed so that in the event of a single cable fault, at least a degraded form of detecting fire within the protected space remains and the system is still capable of at least manual discharge of the extinguishing gas.

If the system is designed so that the maximum area of coverage per detector is generally X m^2, the degraded level of detection should be such that those detectors that remain operational provide a maximum area of coverage of $2X$ m^2 per detector evenly distributed throughout the protected space. The degraded detection should meet at least the spacing and positioning recommendations given in BS 5839-1.

The purpose of this degraded detection is to enable warning to be given to persons so that at least manual operation of the extinguishing system is possible.

This can be achieved by, for example, using two interleaved circuits or a single circuit provided that it is configured as a loop and has suitable short and open circuit protection.

4.3.2 Connection to the fire extinguishing system

If the means for transmission of signals in either direction between the c.i.e. and the e.c.d. is via a non-exclusive circuit, e.g. part of a loop of an addressable system, the connections should be protected against a single cable fault (i.e. both short-circuit and open-circuit) on any part of the circuit, e.g. by the provision of short circuit isolators.

4.3.3 Circuits containing detectors

If detector circuits are common to more than one protected space, the signal to initiate release of the fire extinguishing gas into a protected space where fire has been detected should not contribute to the release of extinguishing gas in another protected space whose detection system uses the same circuit(s).

Manual call points should not in any way influence the release of fire extinguishing gas.

5 Fire detection

5.1 General

The fire detection and fire alarm system should conform to the recommendations given in BS 5839-1:2002 for the appropriate category of system (see Note), unless other standards are more applicable (e.g. BS 6266 for the protection of electronic equipment installations).

NOTE Normally, the category of system will be Category P. However, there might be circumstances in which the fire extinguishing system is installed for the purpose of protecting life, in which case a Category L system (e.g. Category L5) will be appropriate.

5.2 Fire detection within the protected space

5.2.1 General

The detectors used to control the release of an automatic fire extinguishing system should operate in coincidence (see **5.2.2**) unless use of a single detector can be justified, for example:

a) automatic actuation by the operation of a single detector is a requirement of a stakeholder; or

b) the hazard is of such a nature that the delayed response associated with coincidence could be detrimental to life safety; or

c) the area cannot be occupied (e.g. voids and control cabinets).

In any event the probability of a false alarm or failure of a detector should be minimized.

5.2.2 Coincidence

5.2.2.1 If it is intended that gaseous fire extinguishing systems are to be actuated by the operation of a fire detection and fire alarm system, every care should be taken to avoid the consequences of inadvertent discharges, which could be caused by false alarms in the detection system. Operation of automatic detectors in coincidence is one method of minimizing the possibility of false alarms.

5.2.2.2 Detection systems that cannot individually address detectors should provide at least two independent detection circuits to each protected space.

5.2.2.3 In detection systems that can address individual detectors, detectors operating in coincidence may be used on the same circuit, provided that each of the detectors transmits a signal by which it can be independently identified.

5.2.2.4 The two independent input triggering signals required for coincidence should not be derived from the same detector. For example, signals from multiple thresholds of an aspirating smoke detector, or signals from two different elements of a multi-sensor detector, while they might be acceptable to actuate gas discharge in some situations (see **5.2.1**), cannot be considered as coincidence.

5.2.3 Type of detector used

The selection of detectors should be in accordance with the recommendations given in BS 5839-1 and, where applicable, BS 6266.

In some circumstances, fire detection considerations might dictate the need for use of two different principles of detection (e.g. optical smoke detectors and ionization chamber smoke detectors) to ensure the earliest warning of fire. In such circumstances, an even distribution of each type of detector should be provided throughout the protected space. Where coincidence is used, normally it should be possible to achieve coincidence from two detectors of the same operating principle. In these cases, if, for example, two independent circuits are used to achieve coincidence, there should normally be an approximately equal number of detectors of each principle connected to each of the independent circuits. For example, where four detectors are required to protect the space and these comprise two optical smoke detectors and two ionization chamber smoke detectors, there should be one optical smoke detector and one ionization chamber smoke detector on each circuit.

However, it is not always necessary to use two different principles of fire detection. For example, given the type of fire anticipated and the speed of detection required, it might be acceptable to use detectors of a single type.

5.2.4 Spacing and siting of detectors

Detectors should be sited in accordance with the recommendations given in BS 5839-1 for the category of system required. However, where coincidence is used, the minimum detector density should be twice the minimum recommended in BS 5839-1. For electronic equipment installations, the level of detection should be in accordance with BS 6266.

There should be means in the vicinity of the protected space for rapid identification of the location of any hidden detector that is in an alarm condition, e.g. remote indicator lamps or an addressable system in conjunction with a plan of detector locations.

5.3 Fire detection in adjacent areas

5.3.1 Where the protected space and its access are within or adjacent to other areas (possibly controlled by a person or authority other than the client) from which fire could spread, consideration should be given to providing these areas with a fire detection and fire alarm system conforming to the recommendations given in BS 5839-1 for the appropriate category of system.

5.3.2 Detectors beyond the protected space should not control discharge of fire extinguishing gas within the protected space.

6 Control and indicating equipment

The e.c.d. should conform to the requirements specified in BS EN 12094-1.

The c.i.e. should conform to the requirements specified in BS EN 54-2 and BS EN 54-4.

[A1] All input and output circuitry should be monitored, including all connections, for both open circuit and short circuit conditions, and should include the following:

a) sounder circuit(s);
b) power supplies;
c) release, hold and indicating circuits;
d) circuits for initiating inputs, both automatic and manual. [A1]

7 Controls and indications

7.1 Controls

7.1.1 Automatic/manual and manual only mode switch

A switching device should be provided to enable the mode of operation of the fire extinguishing system to be changed, e.g. on entry of persons into an unmanned area.

The mode of operation of the fire extinguishing system should be controlled by either:

a) a manually operated switch, e.g. fitted with a key that can be removed when the key is in either position, and sited adjacent to the main entrance to the protected space; or

   NOTE 1 The switch is intended for use only by an authorized person.

b) a door interlock switch that operates when the door is both closed and locked. This is particularly useful where it is necessary to ensure that the system is in the manual mode of operation when personnel are present in the protected space.

The mode of operation should be in accordance with BS 5306-4 and BS ISO 14520-1 as appropriate.

NOTE 2 When the system is set to the manual mode of operation, it is not necessarily the case that the system is incapable of sudden and inadvertent discharge (e.g. on occurrence of a fault in the e.c.d.). If the gas concentration is likely to be hazardous to life before escape is possible following occurrence of a sudden and inadvertent discharge, further means might be necessary to prevent such an event, e.g. the design of the e.c.d. is such as to ensure, as far as reasonably practicable, that no reasonably foreseeable failure or accident could result in such an occurrence.

NOTE 3 A manual only system does not require a mode switching device.

7.1.2 Manual triggering devices

Manual triggering devices should conform to BS 12094-3.

They should be sited for easy access and the safety of personnel whilst avoiding the possibility of malicious operation, and should be visually differentiated from manual call points provided for operation of the fire detection and fire alarm system.

7.1.3 Pre-discharge warning time

A time delay facility may be incorporated into the system to allow personnel to evacuate the protected space prior to discharge of the fire extinguishing gas. As the delay period will depend upon the potential speed of fire spread and the means of escape from the protected space, it should be as short as possible and should not exceed 30 s unless a longer period is agreed with the stakeholders. Operation of the time delay facility should be indicated by an audible warning signal throughout the protected area (the "pre-discharge warning signal").

NOTE Protracted delays will allow for the further development of the fire and increase the risk of thermal decomposition products from some extinguishing gases.

7.1.4 Emergency hold device

NOTE Emergency hold devices are referred to in some other standards as hold switches.

Where a time delay facility is provided, the system may also be equipped with a single action, biased emergency hold device. This should be distinguishable from all other operating devices, e.g. white with a red button, labelled "EXTINGUISHING HOLD-OFF".

The device should be located near to the exit from the protected space. While being pressed, the device should stop the countdown that will result in gas being discharged. Upon release of the device, and provided that the system remains in the alarm state, the timer should restart from the beginning.

Emergency hold devices should normally be provided if the system is operated in the automatic mode when the protected area is occupied, unless otherwise agreed after consultation with the stakeholders.

There should be a change of the audible warning recommended in **7.1.3** to indicate that the emergency hold device is being operated and there should also be a visual indication at the e.c.d.

The operation of the emergency hold device should not affect the fire alarm signal.

7.1.5 Emergency abort device

An emergency abort device, i.e. a means of interrupting the fire extinguishing countdown sequence such that the fire extinguishing gas cannot be discharged until the e.c.d. has been reset and the actuation sequence reinitiated, should not be provided unless agreed with all stakeholders.

7.2 Indications

7.2.1 Visual indication at entrances

Visual indication of system status should be provided outside the protected space at all entrances such that the system status is clearly and unambiguously indicated to persons entering the protected space.

The indications should be as follows:

- red indicates "released";
- yellow indicates "automatic/manual mode";
- yellow indicates "manual only mode".

NOTE Green has traditionally been used as the colour for the indication for "manual only mode". Yellow is recommended in this part of BS 7273 in view of the requirements of BS EN 12094-1 relating to status indications on the e.c.d.

7.2.2 Indication of detection of fire

There should be a clear visual indication of the operation of the fire detection and fire alarm system within the protected space when the first detector operates, e.g. a flashing beacon (in addition to the audible warning recommended in BS 5839-1), so that the occupants are warned of the possibility of release of fire extinguishing gas. The visual alarm signal should conform to the recommendations given in BS 5839-1.

7.2.3 Audible warnings in the protected area

An audible signal, or signals easily distinguishable from the alarm of fire, should be given at the following stages:

a) during any pre-discharge warning time delay period (see **7.1.3**);

b) when discharge of the extinguishing gas commences.

These two signals may be identical, or, alternatively, two distinguishable signals may be given. The signal given during a) should be silenced while any emergency hold device is being operated, but, if required, may be replaced during this hold period with a signal that is clearly distinguishable from all other signals. The signal given during b) should persist until manually silenced at the e.c.d.

8 Power supplies, cables and wiring

8.1 General

The power supplies for the fire extinguishing system should conform to the recommendations given in BS 5839-1:2002, Clause **25** except that the words "FIRE EXTINGUISHING SYSTEM" should be used in place of the words "FIRE ALARM" in the labels described in BS 5839-1:2002, **25.2**f).

8.2 Wiring for the fire extinguishing system

The wiring for the fire extinguishing system should conform to the recommendations given in BS 5839-1:2002, Clause **26** for cables of standard fire resistance.

NOTE There is no need for segregation of the cables of the fire extinguishing system from cables of the fire detection and fire alarm system.

9 Commissioning and handover

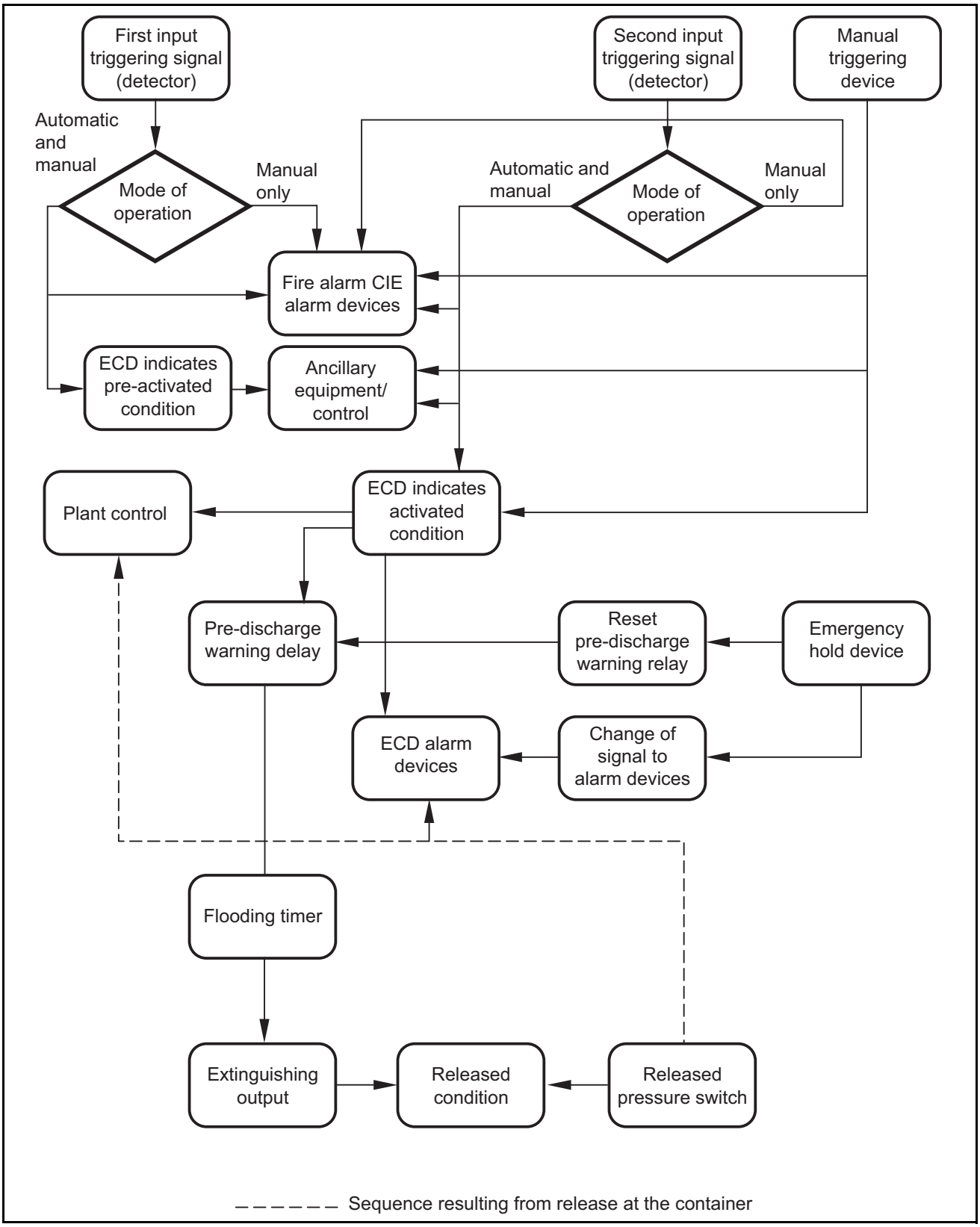
On completion of the installation, adequate instructions on its use and maintenance should be supplied to the person responsible for the use of the premises.

For guidance, refer to BS 5839-1, BS 5306-4 and BS ISO 14520.

Annex A (informative) Typical sequence of actions

Figure A.1 shows an example of a simple diagrammatic representation of a typical sequence of actions leading to the release of fire extinguishing gas.

Figure A.1 **Diagrammatic representation of a typical sequence of actions leading to the release of fire extinguishing gas**



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