BRITISH STANDARD

Code of practice for the operation of fire protection measures

Part 5: Electrical actuation of watermist systems (except pre-action systems)

ICS 13.220.20

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, an inside back cover and a back cover.

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Foreword

Publishing information

This part of BS 7273 is published by BSI and came into effect on 31 January 2008. 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.

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 watermist and sprinkler systems*;
- Part 4: *Actuation of release mechanisms for doors*;
- Part 5: *Electrical actuation of watermist systems*.

Parts 1 and 2 give recommendations for the electrical and mechanical actuation of gaseous fire extinguishing systems respectively. Part 3 provides recommendations for electrical actuation of pre-action watermist and sprinkler systems. Part 4 gives recommendations for the actuation of release mechanisms for doors. This current part of BS 7273 provides recommendations for the electrical actuation of watermist systems (other than pre-action watermist systems).

Recommendations for the design, installation, commissioning and maintenance of fire detection and fire alarm systems are given in BS 5839-1. Recommendations for the design, installation, commissioning and maintenance of watermist systems will be given in DD 8489-1, which is currently in preparation. It is anticipated that an amendment will be issued to BS 7273-5 when DD 8489-1 is published.

Information about this document

There has been a significant growth in the use of watermist fire protection since the demise of halon gas fire extinguishing agents on environmental grounds. Such systems are now used to protect special hazards such as turbines, generators and kitchen ranges. They are also being used for residential applications, such as hotels, for office environments and to protect electrical equipment installations. This part of BS 7273 addresses the interface between the fire detection and fire alarm systems that control watermist systems, and the mechanical components of such systems.

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 frequency transmitters, could potentially trigger watermist systems or cause them to malfunction. In such cases it is essential to avoid the risk of accidental discharge due to the electromagnetic field radiated by such apparatus. It might be necessary to seek specialist advice.

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.

1 Scope

This part of BS 7273 gives recommendations for the design, installation and commissioning of electrical actuation arrangements for watermist systems. It covers the interface between fire detection and fire alarm systems (see BS 5839-1) and watermist systems[1)].

The recommendations are applicable to systems intended either for local application or volume protection.

Recommendations relating to pre-action watermist systems are contained in BS 7273-3.

NOTE Watermist systems can be used for the suppression, control and extinguishing of fires. In this part of BS 7273, the references to watermist systems relate to watermist systems of any type.

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 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*

1) Watermist systems will be covered in DD 8489-1, which is currently in preparation.

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 a 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 watermist 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 watermist system is obtained only after a detector has detected a fire, and at least one other independent detector covering the same protected space or hazard 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 watermist 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 local application system
watermist system designed to provide object protection within a larger overall space

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

3.7 protected space
space protected by a watermist system

*NOTE Volume protection systems are normally used for such spaces (see **3.12**).*

3.8 protected hazard
object protected by a watermist system

NOTE Local application systems are normally used for such hazards.

3.9 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.*

3.10 watermist
water spray for which the $D_{v0,90}$ measured in a plane 1 m from the nozzle at its minimum operating pressure is less than 1 mm

NOTE $D_{v0,90}$ *is the drop diameter such that the cumulative volume, from zero diameter, to the respective diameter, is nine tenths of the corresponding sum of the total distribution.*

3.11 watermist system
one or more watermist installations connected to a water supply

NOTE Watermist systems can discharge water or a mixture of water and some other agent or agents, i.e. inert gases or additives.

3.12 volume protection system
watermist system designed to protect an enclosed volumetric space

4 System design

4.1 General

The requirements for the protected space or hazard(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 effective operation of the watermist system. Such necessary actions should be discussed at the design stage and incorporated within the proposed system.

The system design for fire detection and fire alarm systems should conform to the appropriate provisions of BS 5839-1.

NOTE Recommendations for the design and installation of watermist systems will be given in DD 8489-1, which is currently in preparation.

On the basis of this consultation, the designer should prepare documents showing details of the design. These may include a simple diagrammatic representation of a sequence of actions leading to the discharge of water (see Annex A for an example of diagrammatic representation for a watermist system).

4.2 Operation of the system

Operation of the system should follow a sequence leading to the release of water (for example, see Annex A). This sequence may encompass coincidence (see **3.1**) 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 generate an audible fire alarm warning local to the protected space or hazard (see Annex A). As an alternative, or in addition to this, it may also result in the sounding of the building's fire alarm system.

*NOTE 1 A further, but different, audible warning (the pre-discharge warning signal) is normally required (see **7.1.3**).*

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

For systems with a shared water supply protecting more than one separate protected space or hazard, it can be beneficial to indicate separate released conditions for each protected space/hazard. These would be derived from pressure/flow switches located downstream of the control valves. However, a released condition signal should still be derived from upstream of the valves.

NOTE 2 This will ensure that a warning is generated if water is trapped in the system due to a control valve failing to open.

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 the generation of the local audible warning (and/or sounding of the building's fire alarm system).

Conditions that would prevent the correct operation of the system, e.g. low pressure in propellant gas container(s), may be monitored and indicated as an "incorrect status condition" at the e.c.d.

The operation of any control for disabling the system during maintenance should be monitored and be indicated as a "disabled condition".

Conditions arising from the use of a pumped water supply might need to be monitored.

4.3 Circuit design

4.3.1 Fire detection and fire alarm system

The system should be designed so that in the event of a single cable fault the system is still capable of at least manual discharge of water.

Where coincidence is used, the system should be designed so that in the event of a single cable fault, at least a degraded form of detecting fire remains.

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 watermist 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 or hazard, the signal to initiate discharge of water into a protected space (or over the protected hazard) where fire has been detected should not contribute to the discharge of water in another protected space (or over another protected hazard) whose fire detection system uses the same circuit(s).

The operation of manual call points should not in any way influence the discharge of water.

5 Fire detection

5.1 General

The fire detection and fire alarm system should conform to the recommendations given in BS 5839-1 for the appropriate category of system (see Note). Other standards might also be 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 watermist 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 for the protected space or hazard

5.2.1 General

The detectors used to control the actuation of an automatic watermist system should operate in coincidence (see **5.2.2**) unless automatic actuation by the operation of a single detector can be justified by, for example:

a) it being a requirement of a stakeholder; or

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

c) the fire hazard being of such a nature that the delayed response associated with coincidence could be detrimental to the effectiveness of the system in extinguishing the fire.

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 watermist 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 fire detection system. Careful selection of detector type is particularly important in this regard (see **5.2.3**). Operation of automatic detectors in coincidence is a further method of minimizing the possibility of false alarms.

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

5.2.2.3 In fire 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 two different elements of a multi-sensor detector 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.

The speed of operation required will influence the choice of detector. However, the earliest possible warning of fire might not always be appropriate. For example, smoke detectors operate earlier than heat detectors in many circumstances, and often before there is flaming combustion. In some applications, it would not be appropriate to discharge water at this stage of the fire's development, as watermist is not fully effective unless there is flaming combustion.

In some circumstances, fire detection considerations might dictate the need for use of two different principles of detection (e.g. heat detectors and flame detectors) to ensure effective warning of fire. In some circumstances, an even distribution of each type of detector might be required 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. Where, say, four detectors are required to protect the space, and these comprise two heat detectors and two flame detectors, there should be one heat detector and one flame detector on each circuit.

However, it is not always necessary to use two different principles of fire detection. 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

5.2.4.1 Where practicable (see **5.2.4.4**), detectors should be sited in accordance with at least the recommendations given in BS 5839-1 for the category of system required. Where coincidence is used, the minimum detector density should be twice the minimum recommended in BS 5839-1.

5.2.4.2 For electronic equipment installations, the level of detection should be in accordance with BS 6266.

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

5.2.4.4 In the case of local application systems, the nature and/or arrangement of the protected hazard can dictate a specific configuration of detectors, and detectors might only need to be positioned so as to cover specific parts of the object or process e.g. over fat fryers in a kitchen range. In these cases, the siting and spacing of detectors might not comply with all of the recommendations in BS 5839-1. Where this is the case, the effectiveness of the particular configuration of detectors might need to be demonstrated by fire tests.

5.3 Fire detection in adjacent areas

5.3.1 Where a protected hazard is within a larger space, or the protected space and its access are within or adjacent to other areas (possibly controlled by a person or authority other than the user) 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 or hazard should not control discharge of water within the protected space or around the protected hazard.

6 Control and indicating equipment

In the absence of a standard for electronic automatic control and delay devices for watermist systems, the e.c.d. should conform to the requirements specified in BS EN 12094-1.

NOTE 1 BS EN 12094-1 specifies requirements and test methods for electrical automatic control and delay devices which form part of electrically actuated gaseous fire extinguishing systems. Its requirements are also considered appropriate to e.c.d.s which form part of electrically actuated watermist systems.

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

*NOTE 2 If a pumped water supply is used, additional indicating equipment might be required to indicate alarm and fault conditions. This could also be used to indicate the incorrect status conditions referred to in **4.2**.*

7 Controls and indications

7.1 Controls

7.1.1 Automatic/manual and manual only mode switch

A switching device may be provided to enable the mode of operation of the watermist system to be changed, e.g. to reduce the potential for inadvertent discharge when personnel need to carry out functions that might result in false alarms.

The mode of operation of the watermist 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 close to the protected hazard; 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.

NOTE 2 Recommendations for the mode of operation will be given in DD 8489-1, which is currently in preparation.

NOTE 3 It is not normally necessary to change the mode of operation for personnel safety reasons. Switching to manual only mode is a precaution that can prevent unwanted discharges of water, for example, resulting from routine activities that might activate fire detectors.

NOTE 4 A manual only system does not require a mode switching device.

7.1.2 Manual triggering devices

Manual triggering devices should conform to BS EN 12094-3.

NOTE BS EN 12094-3 specifies requirements and test methods for manual triggering devices which form part of electrically actuated gaseous fire extinguishing systems. Its requirements are also considered appropriate to manual triggering devices which form part of electrically actuated watermist systems, except that they should be labelled "MANUAL RELEASE – Watermist system".

They should be sited for easy access whilst avoiding the possibility of malicious operation.

Particular care should be taken where manual triggering devices for more than one system are installed in close proximity and could be confused, leading to the wrong system being actuated. Suitable labelling should be provided to clearly indicate the protected space or hazard to which each one relates.

7.1.3 Pre-discharge warning time

A time delay facility may be incorporated into the system to allow personnel to evacuate or to allow for the shutdown of equipment prior to discharge of water. Operation of the time delay facility should be indicated by an audible warning (the "pre-discharge warning signal") within the protected space or the vicinity of the protected hazard.

NOTE Delays will allow for the further development of the fire and will not be appropriate in circumstances in which there is rapid fire growth e.g. Class B fires. A delay might not be acceptable to stakeholders.

7.1.4 Emergency hold device

Emergency hold devices are single action, biased switches whose function is to delay discharge of water when operated. They are not needed for personnel safety reasons. If provided, their use could lead to protracted delays, allowing further development of the fire. They should be provided only with the agreement of the stakeholders.

Where provided, they 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 or adjacent to the protected hazard. While being pressed, the device should stop the countdown that will result in water being discharged. Upon release of the device, and provided that the system remains in the alarm state, the countdown should continue. It might be appropriate for the timer to restart from the beginning, but this should be agreed 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 sounding of the fire alarm (see **4.2**), whether that alarm is generated by the local audible warning or the building's fire alarm system [see also **7.2.3**b)].

7.1.5 Emergency abort device

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

7.2 Indications

7.2.1 Visual indication at entrances

For volume protection systems, 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”.

For local application systems, visual indication of system status might be appropriate at the entrances to the area containing the protected hazard.

NOTE Green has traditionally been used as the colour for the indication for “manual only mode” for gaseous extinguishing systems. 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 Visual warnings

Visual indication of the operation of the fire detection and fire alarm system might be appropriate so that personnel in the vicinity are warned of the possibility of discharge of water. The visual alarm signal should conform to the recommendations given in BS 5839-1.

7.2.3 Audible warnings

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 (the pre-discharge warning signal) (see **7.1.3**);

b) when discharge of water 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 watermist system should conform to the recommendations given in BS 5839-1:2002, Clause **25** except that appropriate words e.g. "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 watermist system

The wiring for the fire extinguishing system should comprise cables of standard fire resistance as described in BS 5839-1:2002, Clause **26**.

NOTE There is no need for segregation of the cables of the watermist system from cables of the fire detection and fire alarm system, or for use of cables of enhanced fire resistance.

9 Commissioning and handover

9.1 General

The system should be commissioned and handed over in accordance with BS 5839-1 where appropriate, and with the recommendations given in **9.2** and **9.3**.

NOTE Specific recommendations for the commissioning and handover of watermist systems will be given in DD 8489-1, which is currently in preparation.

9.2 Commissioning

A visual inspection should be undertaken to ensure that the type and location of all equipment is in accordance with the working drawings and design specifications.

Functional tests should be carried out to ensure the correct operation of all controls and indications in **7.1** and **7.2** respectively. The tests should establish the sequence of actions leading to discharge of water, and this should be verified against the sequence of actions in the design documentation (see **4.1**).

As part of this, all auxiliary functions (such as audible and visual warning devices, remote indications, air handling shutdown, power shutdown, etc.) should be checked for correct operation in accordance with design requirements.

For systems with a shared water supply protecting more than one protected space or hazard, the correct function and sequence of actuation of all electrically operated control valves should be fully checked.

Tests should be completed with the system in all modes of operation, i.e. manual only and automatic/manual.

The monitoring and indication of incorrect status and disabled conditions should also be checked by test (see **4.2**).

9.3 Handover

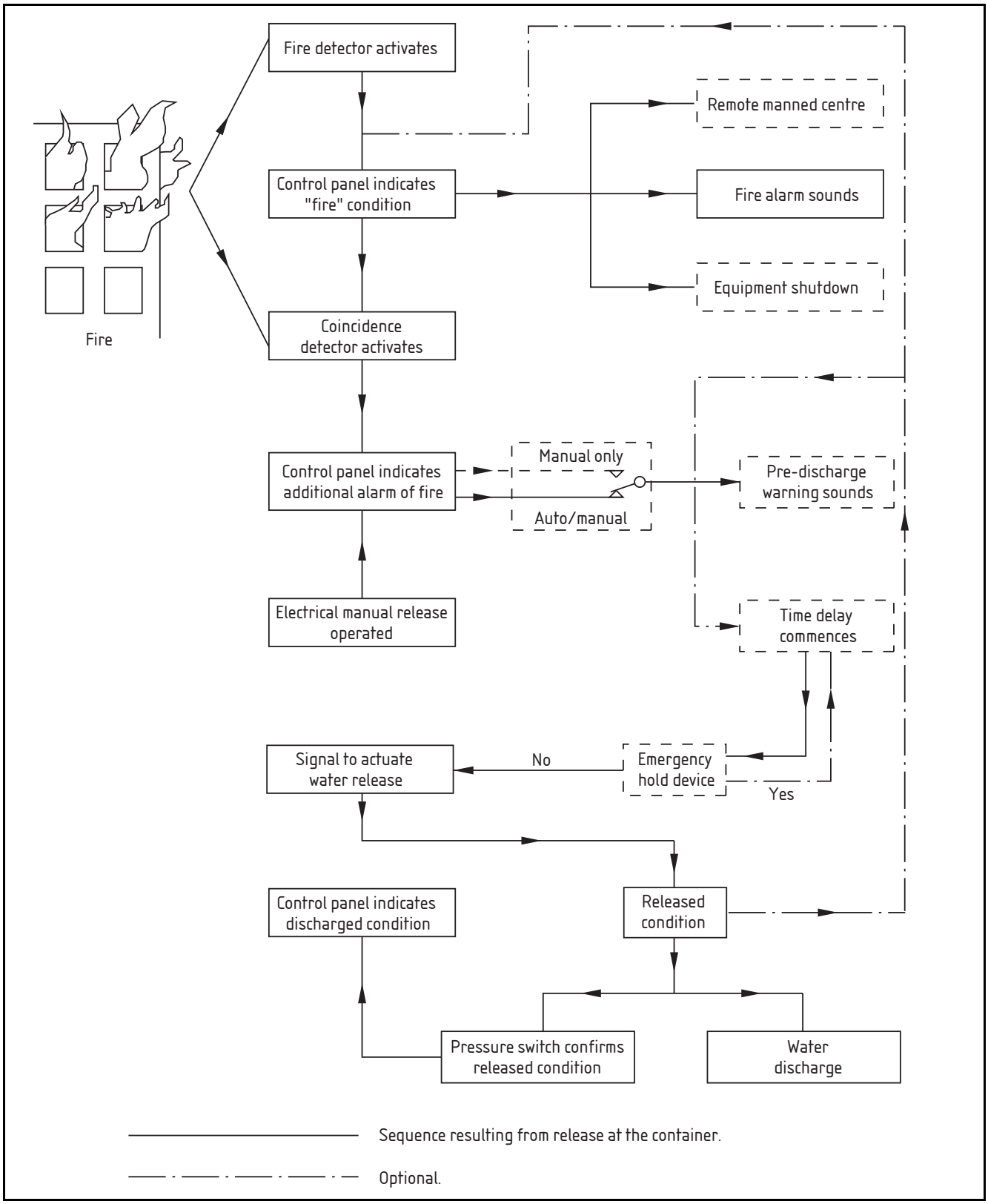
On completion of the commissioning, completion certificates, record drawings and instructions on the system's use and maintenance should be supplied to the user.

For guidance, refer to BS 5839-1.

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 discharge of water from a volume protection system.

Figure A.1 **Diagrammatic representation of a typical sequence of actions leading to the discharge of water from a watermist system**



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DD 8489 (both parts), *Fixed fire protection systems – Commercial and industrial watermist systems* [2)]

[2)] In preparation.

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