

**Guidance
Note**



Fire Industry Association



**Fixed Gaseous Fire Extinguishing Systems
System actuation considerations**

FIA Guidance Document – Fixed Gaseous Fire Extinguishing Systems

System actuation considerations

1. SCOPE	3
2. RELEVANT STANDARDS	3
3. FIRE DETECTION CONSIDERATIONS	4
4. SYSTEM DISCHARGE ACTUATION	4
5. UNWANTED EVENTS AND FALSE ALARMS / OPERATION	5
6. SOME ADDITIONAL POINTS WHEN CONSIDERING THE LOGIC OF A SYSTEM ACTIVATION	5
7. WHEN TO CONSIDER EXCEEDING 30 SECONDS OR A DIFFERENT APPROACH?	7
8. CLOSING REMARKS	7



1. SCOPE

The ethos for automatic gaseous fire protection systems is fast detection and rapid extinguishing. There is a balance between prompt activation and allowing intervention. Guidance is available in the relevant standards namely BS 5839-1 Fire Detection, BS 6266 Protection of electronic installations and BS 7273-1 Actuation of systems. This paper is intended to act as an aide-memoire and introduces some additional considerations relevant today.

The Standards recommend coincidence fire detection (two fire detectors have to alarm, giving first stage with the initial detector and second stage when two or more alarm) followed by up to 30 seconds time delay before discharge of the extinguishant. Other measures may be necessary and in exceptional circumstances a longer discharge delay may be desirable. After careful consideration of all the factors, the logic – “cause and effect” – and justification shall be documented and agreed with all stakeholders.

We trust that stakeholders reading this will appreciate the thought pattern that has gone into the logic of the actuation of a fire extinguishing system and that prescriptive standards have their limitations.

It is important to avoid the wrongly adopted approach of unnecessarily switching the system into the ‘Manual Only’ mode of operation, which is likely to be outside stakeholder and insurer agreement and has further potential for user error, such as a system left in its ‘Manual Only’ mode when the premises are unoccupied, or no personnel are present; leaving the risk unprotected.

2. RELEVANT STANDARDS

BS 5839-1 pertains to the fire detection and alarm systems for life and property protection. In the control of unwanted alarms and the consequences thereof (e.g. unnecessary evacuation); section 3 deals with the limitation of false alarms and unwanted fire alarm signals.

From a life safety consideration, the preference is for all personnel to evacuate upon the first alarm. The automatic gaseous fire extinguishing system is designed to deal with the fire without human intervention. Generally, it is safer that personnel move away from a fire rather than towards it to investigate and put themselves at risk. We realise that some system owners require investigation and manual firefighting prior to the release of the extinguishing system. This will be covered in their own risk assessment.

BS 6266 explains that “The extensive use of fire protection systems in electronic installations arises not from a high probability of fire, nor from a significant hazard to life, but from the consequences of fire loss.” For this reason, fixed gaseous fire extinguishing systems are often needed. Activation of the fire protection system may cause business interruption as well as cost and environmental impact from the fire, and so unwanted operation must also be addressed. However, this is far outweighed by the losses that would occur and consequences from a fire within an unprotected area.

BS 7273-1 fixed firefighting (gas extinguishing) systems typically have a time delay from the initiation of release to the actual extinguishant deployment. BS 7273-1:2006 clause 7.1.3 terms this as “pre-discharge warning time” with reasoning of “...to allow personnel to evacuate the protected space prior to discharge...” and “it should be as short as possible and should not exceed 30s unless a longer period is agreed with the stakeholders.” As well as the stated need for life safety, the delay must also allow time for the unstated associated cause and effect, such as closing of dampers or opening of pressure relief vents, etc. to operate and provide adequate time for reasonable control measures to avert an unwanted release.

Unfortunately, blind adherence to the 30 second maximum pre-discharge delay is often demanded without appreciating the need for variations, thus agreement by stakeholders is often problematic, which this paper aims to address. Note, exceeding 30 seconds should be the exception rather than the rule.

3. FIRE DETECTION CONSIDERATIONS

Fire detectors rely on sensing a change in the local environment. There is a compromise between sensitivity and reliability in that we do not want false alarms; the Standards offer guidance and this paper is intended to provide additional discussion points not to substitute the Standards.

The selection of the detector type and their placement in the protected space will have a profound effect on the logic of the actuation of the fire extinguishing system and the interface with personnel protection and the building services interface. This is discussed in other FIA Guidance Notes (for example: Guidance for Coincidence Connection of Detectors for Triggering Extinguishing Systems; Fire Detection in High Airflow Environments Including Electronic Equipment Installations; Fire Alarm Detector Applications and Documentation of the Selection; etc) as well as Standards (such as BS 5839-1).

4. SYSTEM DISCHARGE ACTUATION

Early intervention is well understood and has benefits such as limiting fire damage, consequential loss, reduced agent decomposition, etc. Where a fast flaming fire is expected, such as Class B (e.g. flammable liquid) hazards, rapid intervention and deployment is highly recommended.

Conversely where a slow rate of growth with an incipient stage is expected, such early intervention is less fundamental – potentially resulting in system deployment before the flaming stage – and this is reflected in the latest ISO 14520 and EN 15004 permitting the discharge time of inert gases in such cases to be extended from 60 seconds to 120 seconds.

In the control panel’s automatic mode of operation, there is a first stage alarm (audible, complemented with visual beacons) and then an audibly distinguishable second stage alarm which normally occurs after the coincidence detection. Manual operation will simultaneously operate both stages of alarms.

Normally a slow incipient fire growth stage is expected in spaces such as data centres; in this case, time is typically afforded between first and second stage alarm. In such circumstances, one would presume a first stage alarm could trigger an investigation and/or possible manual intervention, whereas second stage alarm would initiate evacuation of all personnel and the subsequent gaseous fire extinguishing system release.

As previously explained, BS 7273-1:2006 clause 7.1.3 has the:

- Stated need of personnel evacuation.
- Unstated need of cause and effect (e.g. fans and dampers) as well as manual intervention.

5. UNWANTED EVENTS AND FALSE ALARMS / OPERATION

If there is potential for unwanted occurrences that may initiate an immediate or near instantaneous second stage alarm – but not warrant a release of the fixed gaseous fire extinguishing systems – consideration is necessary, for example:

- An arcing event, such as failing Power Distribution Unit, which would self-extinguish yet probably create a cloud of fire effluent large enough to trigger coincidence operation.
- Mechanical failure of air conditioning plant or pipework releasing a large volume of refrigerant affecting many detectors in quick succession.
- The failure of an electronic component in the airflow which may itself be inconsequential, but the airflow would cause the rapid circulation of any combustion by-products to enter multiple detectors in rapid succession.
- Inadvertent manual operation of an extinguishing release point (yellow break glass unit) in an adjacent area.

In these instances, the site operating procedures would probably initiate evacuation of all personnel, preventing exploration and/or mitigation.

6. SOME ADDITIONAL POINTS WHEN CONSIDERING THE LOGIC OF A SYSTEM ACTIVATION

A holistic approach needs to be employed when authoring the site’s fire strategy and emergency action plan. The strategy must be agreed by stakeholders and documented. Suitable questions to consider, and solutions agreed, might include:

- Do you want personnel to attempt to locate a fire and intervene thus avoiding the discharge of the extinguishing system?
 - In the event of an alarm, will there be trained personnel able to respond and possibly prevent an unwanted fixed gaseous fire extinguishing system release?
 - What is their anticipated response time?
 - Are they likely to be able to think clearly in a fire situation and take the appropriate action?
 - There needs to be a clear risk assessment prior to implementation.

- Do you want personnel to evacuate the protected space upon the first stage fire warning or once the second stage warning is sounded?
 - In the case of something critical, such as an air traffic control room, do you want the personnel to stay?
- Can you ensure that all personnel can evacuate before the system discharge?
 - Consider evacuation routes, obstructions, and the mobility of the people.
 - What are the trained personnel expected to do?
- Consider the access security.
 - Are door interlocks disabled to allow easy evacuation?
 - Is there a need or possibility to integrate the security system to allow first-responders or specific personnel easier access?
- The use of ‘Hold buttons’ is recommended should personnel be delayed in their evacuation (pressing the hold button stops the discharge delay countdown and when released restarts the countdown). The location and number of these hold buttons needs to be considered.
 - Is it advantageous to add more hold-off buttons – or other extinguishing release delay mechanisms – to the system along the access route and/or outside the protected area (if there is the means to assess the situation from outside the protected area) or where security further impedes progress?
- Are there any processes or actions in the cause and effect logic which are triggered from second stage alarm, with their completion being essential for the safe and correct operation of the extinguishing system, that may take longer to complete than the specified delay period (e.g. damper closing, fan run-down time)?
- Is it sensible to program additional timers into the cause & effect logic so a time delay must occur between first and second stage alarm, and keep the pre-discharge delay as short as possible? With modern fire detection and alarm, it may be possible to introduce a delay from first stage alarm – from the first detector operating – and coincidence output which commences the pre-discharge delay as well as operating second stage alarms and triggering evacuation. This approach will allow investigation and possible intervention and still allows pre-discharge delay timers to be kept to the minimum to afford evacuation and the cause and effect– such as dampers – essential to the safe operation of the system; if an appreciable fire is discovered, manual operation of a (yellow) release point will affect rapid agent deployment and minimise fire damage.

7. WHEN TO CONSIDER EXCEEDING 30 SECONDS OR A DIFFERENT APPROACH?

BS 7273-1:2006 clause 7.1.3 states the “pre-discharge warning time ... should be as short as possible and should not exceed 30s unless a longer period is agreed with the stakeholders.”

Stakeholders need to consider site-specific and sometimes unique challenges.

There may be a justifiable need for a change to the cause and effect logic of the system, or possibly even consider a longer delay, to afford the site’s first responders time to intervene and avert an unwanted release. For instance, large data centres, with layers of security and ingress delay measures such as “man-traps” and biometrics, purposefully make access challenging and this could delay first-responders, fire marshals and competent personnel beyond the 30 second period.

Site operating procedures need to be authored as appropriate and kept relevant, for instance where an instantaneous coincidence alarm could occur as exemplified above.

This approach could also save the end user the expense of a full system replenishment, and associated business interruption and on-costs.

Note: EN 12094 allows panel timers a delay of 60 seconds.

8. CLOSING REMARKS

The above is not an exhaustive list but allows engagement with stakeholders to not only consider the correct operation in the event of a fire, but also the means to reduce the likelihood of a release, should a false alarm phenomenon present itself.

One option that can be wrongly adopted is to switch a system into the ‘Manual Only’ mode of operation. Whilst this may achieve the objective of avoiding unwanted automatic operation, this removes all extinguishing protection until human intervention. It is also likely to be outside stakeholder and insurer agreement. This has further potential for user error, a system may be left in its ‘Manual Only’ mode when the premises are unoccupied, or no personnel are present; leaving the risk unprotected.

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