Code of Practice

Fire Industry Association

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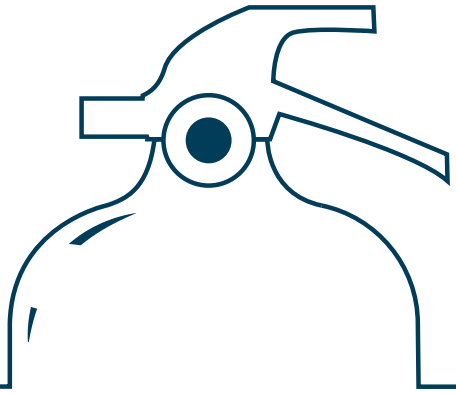

F.I.A. Code of Practice for Indirect Fire Extinguishing (IFE) Pre-Engineered Systems for Unoccupied Cabinet / Enclosure Protection

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1. INTRODUCTION

There are many fire risk applications that, due to certain conditions present in the risk, do not fall into the scope of an applicable established standard. Such conditions might mean that a fire protection solution must be classed non-standard and will require an appropriate level of scrutiny and rigour in the design process.

(Attention is drawn to BS5306-0 (Fire protection installations and equipment on premises – Part 0: Guide for selection, use and application of fixed firefighting systems and other types of fire equipment) and specifically Section 8, Method B: Innovative, engineered or otherwise non-standard solutions).

In the absence of any existing and relevant standards, the objective of this Code of Practice (C.O.P) is to identify all the essential elements of a process, that will enable an IFE system to be correctly assessed, specified, designed, manufactured, and supplied, where the protected risk is an **Unoccupiable Cabinet / Enclosure**. By following the requirements of the C.O.P, this will ensure the IFE System meets the responsible person's requirements, whilst also confirming the basis on which the fire extinguishing system design and performance has been established.

The C.O.P. requires that the manufacturer, supplier, authorised installer, or service provider should have staff, processes, and systems in place to ensure that the product or service delivered meets the requirements.

The responsibility for ensuring compliance with the technical and managerial process and requirements for the product or service detailed in this C.O.P. lies with the manufacturer, supplier, authorised installer, or service provider, as appropriate.

2. SCOPE

This document details the general considerations for the correct specification of pre-engineered IFE Systems for the protection of Unoccupiable Cabinets / Enclosures of Gross volume up to 20m³. Such Cabinets / Enclosures may be single or multi-compartment and may include free vent areas or airflow.

It is intended to cover IFE Systems that fall outside existing fire extinguishing standards and provide guidance on what equipment manufacturers should consider when they assess, specify, design, manufacture and supply an IFE System for this specific application category. It should also provide a guide for responsible persons and specifiers as to what information they should require of manufacturers and service providers, to confirm the suitability of an IFE System being offered.

The C.O.P. allows use of any recognised extinguishing agent and allows total flooding or local application solutions to be proposed, as appropriate to the fire risk, fire class and specific application conditions that are being considered. In the context of this C.O.P. local application means the direct application of the agent onto the hazard that is still contained within an enclosure, unlike the more traditional definition of local application where agent may be applied to a hazard without any agent containment in place.

Fire Extinguishing Systems designed in accordance with this C.O.P. may typically be used for protection of:

- Electrical Enclosures
- Laboratory Fume Cupboards
- Machinery Spaces
- Flammable Liquid Stores
- Machine Tools

There are other fire risks that can be classified as Unoccupiable Cabinets / Enclosures, where other adverse conditions may also require a non-standard solution.

These IFE Systems are not intended for use as whole room or building fire protection systems, which are covered in other applicable standards.

3. TERMS AND DEFINITIONS

1. Airflow

The volumetric (forced) air flow into and out of the cabinet.

2. Authorised installer

A person registered with the IFE System manufacturer, who is trained and authorised to design, install, commission, maintain and service the IFE System.

3. Cabinet

Single contained or multi-sectioned enclosure which has an internal gross volume less than or equal to 20m³.

4. Container

The vessel used to hold the extinguishing agent.

5. Design concentration

The concentration of extinguishant, including a safety factor, required for system design purposes. This may be expressed as, but not limited to, kg/m³ (Powder and Aerosols), L/m² (Foam), % v/v (Gas).

6. Electrical detection system

A system consisting of electrical energised devices to detect fire and release the IFE System.

7. Extinguishing concentration

Minimum concentration of extinguishant required to extinguish a fire involving a particular fuel under defined experimental conditions excluding any safety factor.

8. Flooding quantity

Mass or volume of extinguishant required to achieve the design concentration within the protected volume.

9. Free vent area

The total open, effective area of air vents and unsealed penetrations.

10. Gross volume

Volume enclosed by the protected cabinet, ignoring the volume of any permanent impermeable elements within the cabinet.

11. Indirect Fire Extinguishing (IFE) system for cabinet / enclosure protection

A fire extinguishing system suitable for the protection of Unoccupiable Cabinets / Enclosures. The IFE System incorporates separate fire detection and extinguishing agent discharge functions.

12. IFE system manual

A document or documents provided by the IFE System manufacturer giving full instructions on the design, installation, commissioning, operation, re-charging, maintenance and servicing of the IFE System.

13. Lock-off device

Manual shut-off valve installed into the discharge piping downstream of the agent containers; or another type of device that mechanically prevents agent container actuation.

NOTE:

(1) The actuation of this device provides an indication of system isolation.

(2) The intent is to prevent the discharge of agent into the hazard area when the lock-off device is activated.

14. Manual release device

Device by which an IFE System, can be discharged by intervention of a human operator.

15. Maximum Activation Height (MAH)

A maximum installed height of a detector above the protected hazard.

16. Maximum allowable pressure

Equilibrium pressure inside a container at the maximum operating temperature.

17. Mechanical detection device

A fire detection device that operates mechanically, e.g., pneumatic heat detection system, fusible links.

18. Pneumatic heat detection system

A system filled with gas which, when heated, activates, releasing the fire extinguishing agent.

19. Pre-engineered system

System consisting of a supply of extinguishant of specified capacity coupled to pipework with a balanced nozzle arrangement up to a maximum permitted design.

NOTE: *No deviation is permitted from the limits specified by the manufacturer or authority.*

20. Pressure relief device

A device, fitted to a cabinet or any compartment within a multi-compartment cabinet, that relieves excess pressure within a cabinet, caused by discharge of the IFE System.

21. Responsible person

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

22. Safety factor

Multiplier of the agent extinguishing concentration to determine the agent minimum design concentration.

23. Service provider

A person registered with the IFE System manufacturer or supplier, who is trained and authorised to maintain and service the IFE System.

24. Unoccupiable

Area which cannot be occupied due to dimensional or other physical constraints.

4. REQUIREMENTS

Hazard assessment

Attention is drawn to BS5306-0, Clause 4, which details all the elements that should be considered when conducting a hazard assessment that will input into the design of the IFE System. Such considerations will, as a minimum, include the following factors:

- **Type of fire risk and magnitude of fire load**
  - – Risk type
  - – Fire class: A, higher hazard class A, B, D, F, electrical
  - – Fire load

- **Adverse conditions**
  - – Free vent areas (openings)
  - – Airflow (fans)
  - – Location of vents / fans
  - – Volume of cabinet / enclosure
  - – Internal geometry / shielding of cabinet / enclosure
  - – Re-ignition sources
- **Possible re-ignition mitigation actions**
  - – Vent closure
  - – Fan isolation
  - – Equipment isolation
  - – Cooling
  - – Smothering
  - – Retention of extinguishant concentration
- **Extinguishant delivery method**
  - – Total flooding
  - – Local application
- **Review and analysis of relevant fire and loss experience**

Based on the hazard assessment and consultation with the responsible person and other interested stakeholders, the general design, specification, and capacity of the IFE System (the mass / volume and type of the extinguishing agent) should be established by:

- Selection of the most appropriate reference standard, if appropriate (existing standards, proven components and concepts reduce the risk of the innovative solution).
- Reference to the manufacturer's IFE System manual.
- Evidence of applicable fire testing, incorporating any foreseeable conditions identified in the hazard assessment. The applicability of the fire testing to the application should be justified.
- Selection of suitably tested and certified components. Cross-reference should be made to appropriate component testing during other relevant standard certification activities.
- Identifying where engineering judgment is applied as part of the substantiation of a proposed engineered solution. It is important to understand how judgement has been applied, especially in cases where test data, guidance from published standards, or other information is being extrapolated in support of the proposed engineering solution.

Other design requirements

Capacity

IFE Systems should be capable of providing protection for single or multi-compartment unoccupiable cabinets and enclosures up to the volumetric capacity of the cabinet / enclosure being protected.

The design concentrations / extinguishing agent flooding quantity should allow for losses due to all identified adverse conditions, including un-closable openings, forced ventilation, fan rundown time etc.

IFE Systems should be capable of extinguishing and preventing re-ignition of the identified fire risk and fire class in cabinet / enclosures of the specified volume for a specified time.

Detection equipment

The IFE System should be capable of being activated by a suitable detection device. These may include, but are not limited to, either:

a. Heat sensitive mechanical detection devices

b. Electrical detection devices in compliance with BS EN 54

Note: *Consideration should be made of the robustness of the detection devices since some cabinet / enclosure applications can present contaminating and corrosive conditions.*

The limits of performance for any detection devices should be defined in the IFE System manual.

Manual release

The IFE System should be capable of being fitted with a manual release device positioned externally to the cabinet / enclosure. In the absence of a mechanical manual release device, an electrical manual release may be supplied. Any operational risk assessment should consider the most appropriate location of any manual release device, if fitted.

IFE system isolation

The IFE System should include a lock-off device, or other means of isolation, such that the IFE System is capable of being isolated to allow servicing and maintenance of both the IFE System and the equipment contained within the cabinet / enclosure. This capability should be supported by a written safe system of work which is included in the 'handover documentation'.

IFE system status notifications and associated actions / integrations

Upon activation, the IFE System should be capable of isolating any power supply associated with the protected cabinet / enclosure. Where this is not implemented, a statement should be included in the design specification and in the associated 'handover documentation'.

It should not be possible for the user to isolate any electrical power supply or alarm connections to the IFE System without also isolating the power supply to the cabinet / enclosure or placing the IFE System into an alarm status.

If the end user does not require operational shut down of the cabinet / enclosure during IFE System maintenance this should be clearly stated in the equipment documentation and training.

The IFE System should display, monitor, and provide a false alarm and separately a discharge alarm, both as separate stand-alone alarm units or via connection to a fire control panel.

The IFE System design should provide outputs at commencement of system discharge, which can be configured to shut down associated equipment e.g., Power Supplies, Fans, Pumps, as required.

Note: *Warning devices may not be required based on risk assessments for remote or isolated locations.*

Identification

The IFE System should be supplied with labels for fixing to the cabinet / enclosure, stating that the cabinet / enclosure is fitted with an IFE system and should include the contact information for the IFE System installer and local site responsible person.

On large cabinets the labels need to be affixed at each entry / access point to the cabinet.

Extinguishing agents

Where extinguishing agents used in IFE Systems protecting cabinets / enclosures, may permeate into surrounding occupied areas, post discharge room venting should be considered to protect personnel and mitigate the possibility of the extinguishing agent setting off alarms or systems in adjacent areas.

Pressure relief venting

Where there is a possibility that the IFE System can generate adverse pressure conditions within the cabinets / enclosures being protected, consideration should be given to fitment of pressure relief devices, as required.

Note: *For guidance refer to BS EN 15004-1, BS 5306-4, PD CEN ISO TS21805, BS EN 15276 Part 2, as appropriate.*

Loss of power

Any IFE System that requires power to operate should be provided with a back-up battery power supply, to enable an IFE System to function, detect and discharge, in the event of a power loss. Battery capacity should allow an IFE System to function for the same duration as the associated fire alarm system requirements.

Limitations

The verification of an IFE System is essentially a confirmation by the manufacturer, of the IFE Systems performance against the requirements of the responsible person / stakeholders and parameters specified as part of the hazard assessment and design review.

The requirements of this C.O.P. are those which generally will enable a satisfactory evaluation of an IFE System to be made. However, the responsible person should reserve the right to apply special considerations, dependant on the scope of application of an IFE System, if it is not adequately dealt with by the C.O.P.

Even though adverse conditions may exist in a cabinet / enclosure, where possible, to maximise extinguishing performance and minimise re-ignition, electrical power supplies, including those to fans, should be isolated, vents closed, and machinery stopped upon commencement of IFE System discharge.

Specific minimum performance limitations and application guidance should be adhered to for each extinguishing agent type, by documented interpretation and extrapolation (if required), of the requirements in the following standards:

- **Aerosols**

  Maximum discharge time and agent density should be established by reference to BS EN 15276-1.

- **Foam**

  Minimum application rates and foam quantity should be established by reference to BS EN 13565-2.

- **Gas**

  Maximum discharge times and minimum design concentrations should be established by reference to the applicable parts of BS EN 15004, or BS 5306-4

- **Powder**

  Maximum discharge times and minimum design concentrations should be established by reference to BS EN 12416-2

Design documentation

All details of the derived solution should be fully documented. Documentation should be available to review by any stakeholder and should include the hazard assessment and design review, together with confirmation of compliance with all other design requirements detailed above and the solutions offered.

IFE System Manual Requirements

Whilst the hazard assessment, design review and associated documents will confirm the design features and capacity of a specific IFE System, the IFE System manual, together with any associated documents should address the following generic features of the IFE System, and should be used as a basis for the training and monitoring of authorised installers or service providers:

a) Scope of applications and their limitations, i.e., risk types, numbers, and dimensions of equipment that may be protected.

b) Design considerations, principles, methodology and guidelines.

c) Installation, commissioning, servicing, maintenance, and reset / recharge procedures.

d) Health and safety requirements; including details such as (national or local) regulatory requirements, SDS data for the extinguishing agent, warnings regarding toxicity and environmental impacts, including those for personnel (not only those working on the IFE Systems for installation or maintenance but also working in the general area) and equipment, potentially affected by agent discharge events.

Design Considerations

Application limits (as appropriate)

The application limitations for the IFE System design should be stated and address, as a minimum:

a) The types and capacities of fire risks and fire classes to be protected within the enclosure, including any application exclusions such as types of materials or risk not covered.

b) The volume and maximum single dimension of the cabinet / enclosure that can be protected by a specific IFE System capacity, subject to any adverse conditions.

c) The number of compartments within the cabinet / enclosure.

d) The maximum free vent area.

e) The maximum airflow.

f) The level of shielding / obstructions that an IFE System can tolerate, if any.

Operating parameters (as appropriate)

The operating parameters for the detection and extinguishing components should also be stated including:

a) Fire Extinguishing performance based on either total flooding or local application principles, including design concentration or nozzle coverage.

b) Operating temperature range for the IFE System.

c) Operating pressure range for the IFE System.

d) Temperature and pressure operating ranges for the detection devices as appropriate.

e) Physical limitations of any detection devices, including placement and routing.

For mechanical detection devices, the manual will define maximum lengths, maximum distances between control valves and possible detection points / manual actuator positions, minimum radii, maximum number of bends per metre, fixing details, material compatibility with the environment.

f) Proximity requirements in terms of the Maximum Activation Height (MAH) and minimum distances, if applicable, of any detection devices from the defined risk. These dimensions should be evidenced by relevant testing.

g) Physical limitations of the discharge nozzles and pipework, including placement and routing, definition of maximum / minimum length of discharge pipework, maximum / minimum distance to nozzles, numbers of nozzles – maximum / minimum.

h) Limitations on distribution, where the IFE System is protecting multiple compartments within the cabinet / enclosure.

i) Confirmation of extinguishing agent minimum discharge performance requirements under all adverse environmental conditions, as detailed in the section '**Limitations**'.

j) Whether or not it is required that any associated equipment should be shut down upon IFE System actuation.

Installation

The IFE System manual should state that all installation activities should only be undertaken by authorised installers who are approved by the IFE System manufacturer under this C.O.P. In addition, the manual should contain details, where applicable, of:

a) Applicable working practice and training requirements.

b) Details of any specialised tools or equipment.

c) Fitting requirements such as tightening torques etc.

d) Health and safety details and practices.

e) Operating temperature ranges.

f) Fitting details for containers including provisions for transportation and installation of safety systems.

Commissioning

The manual should include a check list and operational details for the commissioning of the system and for re-instatement of the IFE System following maintenance or IFE System reset. This should cover as a minimum:

a) If applicable, Pressure and IFE System leak test (to include all permanently pressurised components present in the system).

b) Discharge pipework integrity pressure test.

c) For mechanical detection devices, the requirement for clear runs, no burrs, kinks, or excessive curvatures, as appropriate.

d) Operation of electrical detection devices.

e) Operation of fault alarms and power cut outs.

f) Safety warning notifications and hand over documentation.

g) Cabinet integrity test, where possible / applicable, for gaseous or aerosol extinguishing IFE Systems.

Servicing and maintenance

The manual and associated end user guides should state:

a) That only authorised installers or service providers should service and maintain the IFE Systems.

b) The service periods and required service activities, including replacement of components, review of protected equipment etc. servicing with approved spare parts, to include:

   i. Checks on condition and function of switches, pressure switches, gauges, mechanical detection devices (condition and location), electrical detection devices, IFE System pressure testing, nozzles (positioning / aiming, cleanliness and presence of blow-off caps, if specified).

   ii. Risk assessment – has the designated risk or equipment configuration changed from the original installation?

c) Guidance to end users regarding cleaning or maintenance activities and change of use of any protected equipment or risk.

d) Handover and support to end users. This should include the training and documentation provided to end users, to ensure the on-going operation of the IFE System and should include any regular IFE System testing requirements and service intervals, together with details of activities following IFE System reset and recharge. The documentation should also include details of safe systems of work, which define IFE System isolation procedures prior to access to the cabinets (s) being protected by the IFE System. These are separate to any safe systems of work, which are defined by and the responsibility of the end user, relating to safe isolation of the equipment being protected.

e) Requirements for both authorised installers, service providers and end users following IFE System operation or fault.

Details of components and auxiliary equipment

The manual should include details of all components and auxiliary equipment used for the installation and maintenance of the IFE Systems (including spares and consumable products):

a) Full description; including part numbers and images (as appropriate), allowing identification of each component.

b) Operating parameters such as temperature and pressure ranges.

c) Material compatibility with the working environment.

Manufacturers should include details of any 3rd Party testing or reference certification which supports the inclusion of components into the final IFE System design.

Training requirements

The training programme provided to the authorised installer, service provider or end user by the manufacturer or supplier, should be provided in document form and via practical training, as necessary.

Copies of the training records and certificates should be maintained by the manufacturer or supplier for those successfully completing the training course.

The manufacturer or supplier should have a controlled system to keep their trained installers informed of product updates and critical issues. The methodology for update programmes and the frequency of refresher courses should be documented and evidence of attendance at such courses should be readily available.

The design and installation of IFE Systems should be controlled by the manufacturer or supplier. Only installers or service providers authorised and controlled by the manufacturer or supplier should undertake the installation, service, and maintenance of the IFE Systems.

Training should include instructions to suppliers to maintain a record of all installations and complaints, including a requirement to notify the manufacturer immediately of any failures of equipment in service.

5. MARKING, LABELLING & PACKAGING

The manufacturer should provide appropriate marking, labelling, and packaging for the safe transport and subsequent use of the product as well as clear details of the manufacturer, their contact address, the product model identification, and any other safety requirements.

Each Container should be fitted with a label that is visible when the container is installed, with reference to the following information (where applicable):

- Model reference
- Manufacturers / suppliers identification
- Extinguishing agent and capacity
- Propellant gas
- Operating pressure at specified temperature
- Maximum allowable pressure
- Container test pressure
- Operating temperature range
- Appropriate warnings related to pressure safety
- Any general recommendations for inspection, servicing, maintenance, and re-filling

Each installation should be fitted with a permanent label or labels at all cabinet / enclosure access points, providing the following details:

- The date of installation
- The service intervals
- The contact details of the authorised installer / service provider
- Warning not to alter or modify the installation without reference to the authorised installer or manufacturer
- Warning to disable the system before working inside the protected cabinet / enclosure

Packaging should be suitable to protect the pressurised container and components from potential damage that could be caused whilst in transit.

6. REFERENCES

Publication title

BS 5306-0 (Fire protection installations and equipment on premises – Part 0: Guide for selection, use and application of fixed firefighting systems and other types of fire equipment).

BS 5306-4 (Fire extinguishing installations and equipment on premises – Part 4: Specification for carbon dioxide systems).

BS EN 54 (Various) Fire detection and fire alarm systems.

BS EN 12416, Part 2 (Fixed firefighting systems. Powder systems – Design, construction, and maintenance).

BS EN 15004 (Series) – Fixed Fire Fighting Systems – Gas Extinguishing Systems.

BS EN 15276, Part 1 (Fixed firefighting systems. Condensed aerosol extinguishing systems – Requirements and test methods for components).

BS EN 15276, Part 2 (Fixed firefighting systems. Condensed aerosol extinguishing systems – Design, installation, and maintenance).

PD CEN ISO TS21805 (Guidance on design, selection and installation of vents to safeguard the structural integrity of enclosures protected by gaseous fire-extinguishing systems).

Note: *For undated references please refer to the latest published issue.*

DISCLAIMER

The information set out in this document is believed to be correct in the light of information currently available but it is not guaranteed and neither the Fire Industry Association nor its officers can accept any responsibility in respect of the contents or any events arising from use of the information contained within this document.

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