INTERNATIONAL STANDARD

ISO 7240-14

First edition
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Fire detection and alarm systems —

Part 14: Design, installation, commissioning and service of fire detection and fire alarm systems in and around buildings

Systèmes de détection et d'alarme d'incendie —

Partie 14: Conception, installation, prise en charge et entretien des systèmes de détection d'incendie et d'alarme d'incendie à l'intérieur et autour des bâtiments

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and alarm systems*.

This first edition cancels and replaces ISO/TR 7240-14:2003.

ISO 7240 consists of the following parts, under the general title *Fire detection and alarm systems*:

— *Part 1: General and definitions*

— *Part 2: Control and indicating equipment*

— *Part 3: Audible alarm devices*

— *Part 4: Power supply equipment*

— *Part 5: Point-type heat detectors*

— *Part 6: Carbon monoxide fire detectors using electro-chemical cells*

— *Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization*

— *Part 8: Carbon monoxide fire detectors using an electro-chemical cell in combination with a heat sensor*

— *Part 9: Test fires for fire detectors* [Technical Specification]

— *Part 10: Point-type flame detectors*

— *Part 11: Manual call points*

— *Part 12: Line type smoke detectors using a transmitted light beam*

— *Part 13: Compatibility assessment of system components*

— *Part 14: Design, installation, commissioning and service of fire detection and fire alarm systems in and around buildings*

— *Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor*

— *Part 16: Sound system control and indicating equipment*

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— *Part 17: Short-circuit isolators*

— *Part 18: Input/output devices*

— *Part 19: Design, installation, commissioning and service of sound systems for emergency purposes*

— *Part 20: Aspirating smoke detectors*

— *Part 21: Routing equipment*

— *Part 22: Smoke-detection equipment for ducts*

— *Part 23: Visual alarm devices*

— *Part 24: Sound-system loudspeakers*

— *Part 25: Components using radio transmission paths*

— *Part 27: Point-type fire detectors using a scattered-light, transmitted-light or optical or ionization smoke sensors, an electrochemical-cell carbon-monoxide sensor and a heat sensor*

— *Part 28: Fire protection control equipment*

The following part is under preparation:

— *Part 29: Video fire detectors*

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Introduction

The installation of a fire detection and alarm system can only be successfully accomplished if the following conditions are fulfilled:

— materials are of a suitable quality;

— special knowledge in the field of fire detection and fire alarm;

— skilled personnel to carry out the work.

Although the quality of the material can be ensured by proper standards and quality audits, the overall effectiveness of an installation depends widely on the quality of work, the experience of the designer and installer, and regular service.

This part of ISO 7240 has been prepared by ISO/TC 21/SC 3. A number of existing national codes and standards were reviewed during the preparation of this edition of this part of ISO 7240. Although there are minor differences in, for example, detector spacing requirements, each code or standard has the same objective of early fire detection. This part of ISO 7240 specifies the minimum requirements for fire detection and alarm systems using equipment complying with ISO 7240.

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Fire detection and alarm systems —

Part 14: Design, installation, commissioning and service of fire detection and fire alarm systems in and around buildings

1 Scope

This part of ISO 7240 specifies the design, installation, commissioning, and service requirements for a fire detection and alarm system (FDAS) (see ISO 7240-1, Figure 1), which is primarily intended to provide early detection of fire and notification within one or more specified indoor or outdoor areas for the protection of lives. The FDAS includes automatic detection of a fire and manual initiation of a fire alarm, with audible and visual warning to people within the detection area.

This part of ISO 7240 also specifies requirements for FDAS capable of providing signals to audible warning systems in accordance with ISO 7240-19, to initiate the operation of ancillary technical services, such as fixed fire extinguishing systems, and to other precautions and actions.

The protection of property is outside the scope of this part of ISO 7240. However, the requirements specified herein may be used as recommendations for property protection.

2 Normative references

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

ISO 7240 (all parts), *Fire detection and alarm systems*

ISO 8201, *Acoustics — Audible emergency evacuation signal*

ISO 21927 (all parts), *Smoke and heat control systems*

IEC 60331-23, *Tests for electric cables under fire conditions — Circuit integrity — Part 23: Procedures and requirements — Electric data cables*

IEC 60331-25, *Tests for electric cables under fire conditions — Circuit integrity — Part 25: Procedures and requirements — Optical fibre cables*

IEC 60364, *Electrical installations of buildings*

IEC 61672-1:2002, *Electroacoustics — Sound level meters — Part 1: Specifications*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7240-1 and the following apply.

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3.1.1
alarm zone
DEPRECATED: emergency loudspeaker zone
geographic subdivision of the premises in which one or more alarm devices are installed and for which a common zonal alarm indication is provided

3.1.2
area of coverage
area, inside and/or outside a building or structure, where the FDAS meets the requirements of this part of ISO 7240

Note 1 to entry: Certain parts of an area can be excluded (see 6.7.3).

3.1.3
contiguous
adjacent to, and mutually accessible

3.1.4
designated entry point
location where access is gained to the building in an emergency

3.1.5
detection zone
geographic subdivision of the premises in which one or more points are installed and for which a common zonal detection indication is provided

3.1.6
enclosure
space defined by boundary elements

[SOURCE: ISO/TR 13387-6:1999, 3.2]

Note 1 to entry: Typical enclosures are walls, floors, and ceilings of buildings and do not refer to cabinets used to house equipment.

3.1.7
escape route
path of escape from any part of a building to a final exit

3.1.8
extra-low voltage
any voltage which cannot exceed AC 50 V or DC 120 V

3.1.9
fire compartment
reference volume delimited by construction elements for which fire resistance has been chosen according to the plausible fire that could break out within this volume or penetrate into it

[SOURCE: ISO 26802:2010, 3.20]

3.1.10
level surface
surface, roof, or ceiling with a gradient less than or equal to 1 in 8

3.1.11
monitoring service provider
agency or organization that receives FDAS signals

3.1.12
quiescent condition
functional condition characterized by the absence of the alarm, fault warning and disabled and test conditions

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3.1.13
sloping surface
surface, roof, or ceiling with a gradient greater than 1 in 8

Note 1 to entry: A sloping surface may not be flat and includes barrel-vaulted ceilings.

3.1.14
sole occupancy unit
room or other part of a building for occupation by one or joint owners, lessees, tenants, or other occupiers to the exclusion of any other owner, lessee, tenant, or other occupiers

3.2 Abbreviated terms

CO carbon monoxide

EMC electromagnetic compatibility

FDAS fire detection and alarm system

FACIE fire alarm control and indicating equipment

FDCIE fire detection control and indicating equipment

4 Equipment and material

4.1 Quality of components

4.1.1 Components used as part of the FDAS shall be designed and manufactured in accordance with a recognized quality system.

4.1.2 The equipment manufacturer shall make available to the FDAS designer information about the manufacturer's quality assurance system to satisfy the designer that the components selected for the FDAS are suitable for the application.

4.2 Standards

4.2.1 Where available, components of the FDAS shall comply with equipment specified in ISO 7240. If International Standards do not exist, then the equipment shall comply with standards permitted by national requirements.

4.2.2 Equipment used in the FDAS shall be certified for compliance with the relevant part of ISO 7240 or other International Standards, as appropriate, by a testing laboratory that is accredited by a national body to assess equipment in accordance with the relevant standard. Where assessment has not been made by an independent party, the designer shall identify the components and describe why assessment has not been undertaken.

4.3 Environmental requirements

Each item of equipment shall be installed within an environment for which it has been certified. Additional requirements may apply in special cases, e.g.:

— potentially explosive atmospheres;

— special EMC requirements;

— extreme climatic conditions.

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4.4 Additional equipment

4.4.1 Additional equipment (e.g. remote terminals or graphic displays) may be included in the design of, or connected to the FDAS.

4.4.2 The operation of the FDAS shall not be reliant on the additional equipment.

4.4.3 Failure of any additional equipment shall not affect the correct operation of the FDAS.

4.5 Installation materials

4.5.1 Installation material (e.g. cable clamps, centenary cables, and cable trays) shall be of a suitable rating, size, and strength to meet the design load requirements.

4.5.2 Connectors and distribution boxes shall be suitable for the size of cables used in the FDAS.

5 Compatibility

5.1 Responsibility

5.1.1 The designer shall ensure that equipment complying with ISO 7240 used in the FDAS has been independently assessed as compatible with the FDCIE, in accordance with ISO 7240-13.

5.1.2 Where the design of the FDAS allows the use of additional equipment connected to the FDCIE (e.g. remote terminals or graphic displays), the designer shall ensure that the equipment has been assessed as compatible with the FDCIE, in accordance with ISO 7240-13.

5.1.3 Where the requirements of ISO 7240-13 do not directly apply, then it may be used as a guide to prepare a suitable compatibility assessment procedure.

5.2 Documentation

The designer shall prepare a list of all components used in the FDAS and identify which components are compatible.

5.3 Certification

5.3.1 Certification of compatibility of equipment used in the FDAS shall be included in the design documentation for the FDAS.

5.3.2 Where assessment has not been made by an independent party, the designer shall identify the components and describe why assessment has not been undertaken.

5.3.3 Where the FDAS interfaces to another system (e.g. building-management system) using voltage-free relay outputs, then self-assessment may be made by the designer and documented accordingly.

5.3.4 Where the fire detection system interfaces to another system (e.g. fire alarm system) using a high-level link (e.g. serial data communication), the designer shall prepare a suitable test plan to ensure reliable interfacing, including the testing of failure and fault modes. This may be done in conjunction with the equipment manufacturer.

6 Design

6.1 Responsibilities

Design of the FDAS, including components and usage requirements, shall be undertaken in a systematic process in accordance with a quality system. A document shall be signed by a responsible person

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describing the field of responsibility in such detail that undefined areas and areas overlapping with other responsibilities are avoided.

6.2 Qualifications

The design of the FDAS shall be undertaken by persons having professional qualifications or experience relevant to the scope of the particular design requirements. Experience may include

— an engineer with proven experience in the field of fire detection and alarm technology,

— an experienced consulting company, or

— an experienced FDAS designer.

NOTE National regulations might exist for the registration and recognition of individuals with the requisite qualifications and experience. The recognition might form part of a recognized competency framework.

6.3 Documentation required for the design

6.3.1 The designer shall have access to documentation necessary to design the FDAS, in accordance with the requirements of this part of ISO 7240. Documentation shall include the following:

— plans of the building;

— use of the building (where known);

— occupancy of the building (where known);

— description of the hazard, including proposed use of detection zones and alarm zones;

— description of the environmental conditions, such as

  — temperature,

  — humidity,

  — corrosive atmosphere,

  — electromagnetic influences (e.g. areas subject to severe thunderstorms);

— description of the environment where the equipment is installed (e.g. occupancy of the building, hazardous locations);

— description of the infrastructure of the environment (e.g. traffic conditions, communications, electricity supply, fire brigade access, water supply, etc.).

6.3.2 The designer shall state any assumptions made and provide justifications for solutions selected.

6.4 Fire detection and alarm system design

6.4.1 An FDAS shall be designed in accordance with requirements of this part of ISO 7240. The design criteria shall satisfy national fire safety objectives and include

— environmental conditions,

— type of occupancy,

— probability of ignition,

— rate of fire growth,

— rapid detection of fire,

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— timely evacuation of people (including the use of alarm zones, phased evacuation, or other evacuation strategies), and

— minimization of unwanted alarms.

NOTE Where national fire safety objectives or regulations do not exist, it is important that the designer applies fire safety engineering principles and a risk-based approach to the design.

6.4.2 The design may exclude from the area of coverage defined areas rarely or never occupied by people or combustible material.

6.4.3 Where complete fire detection coverage (with excluded areas identified in 6.4.2) is not required, and as permitted by national regulations, the following areas may be included within the scope of the design (see 6.3):

— one or more fire compartment(s);

— part of a fire compartment;

— escape route(s); and

NOTE 1 Escape route coverage may not detect a fire at the source of the fire.

— equipment within a building.

NOTE 2 Detectors are typically mounted within or adjacent to the equipment cabinet.

6.4.4 Where automatic detection is not required, and as permitted by national regulations, a system of manual call points may be installed (see 6.9).

6.4.5 Where the design of the FDAS includes the use of optional functions specified in the relevant equipment standards, the use of the option and the reason shall be included in the design documentation.

NOTE National regulations might require the use of some optional functions or might prohibit the use of some optional functions.

6.4.6 The design shall consider any national regulations that place other limitations on the design, such as

a) the size of detection zones and alarm zones;

b) the maximum number of points installed in a detection zone;

c) limitations of circuits including automatic and manual initiating devices;

d) interface requirements to a sound system for emergency purposes;

e) special requirements for circuits having both detectors and alarm devices;

f) special requirements for the combination of initiating and alarm circuits;

g) requirements for fire alarm and fault warning transmission systems;

h) use of installation material, such as shielded cable, conduits, etc;

i) installations in explosive atmospheres.

6.5 Detection zones

6.5.1 General

The building shall be divided into detection zones so that the origin of the alarm can be quickly determined from the indications at the FDCIE and on the detectors.

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6.5.2 Detection zone limitations

6.5.2.1 A detection zone shall be limited to no more than 2 000 m^2 of contiguous floor area or 2 000 m^2 of non-contiguous floor area with no entrances to adjacent areas being separated by more than 10 m and visible from each other. The longest dimension shall not exceed 100 m and shall be confined to one storey. Areas with no access from inside the building shall be displayed as separate detection zones from those having internal access. For an example of detection zone allocation, see Figure 1.

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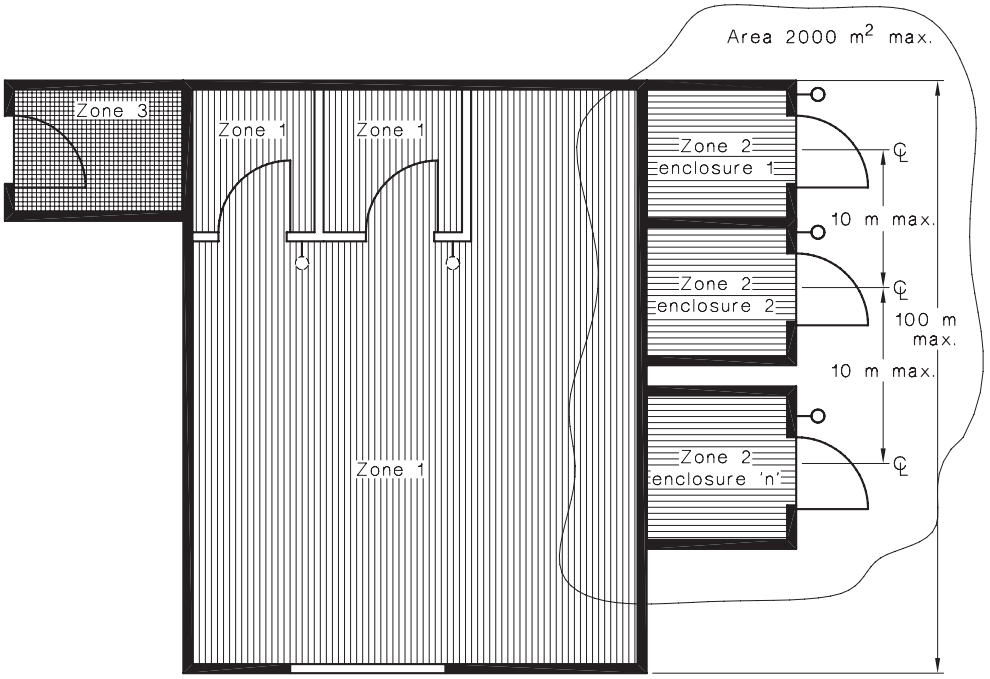
Dimensions in metres

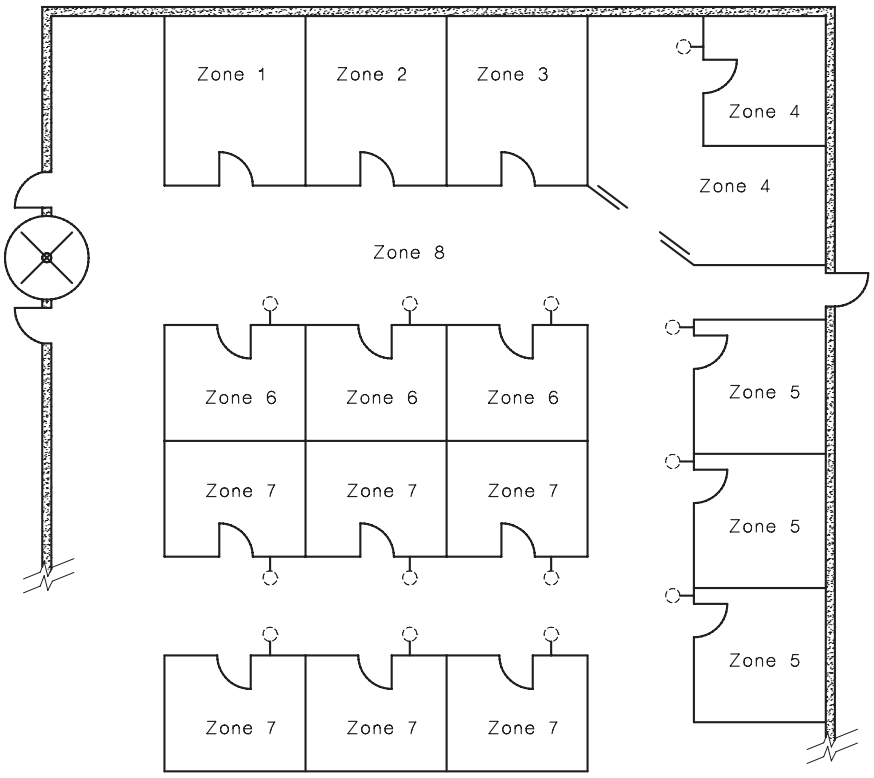


Key

—○ remote indicator (required only when doors kept locked)

—O remote indicator

(a) Industrial



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Key

—○ remote indicator required when access is restricted

(b) Retail/Commercial

Figure 1 — Example detection zone allocation for contiguous and non-contiguous areas

6.5.2.2 A mezzanine level, open to and accessible from the floor with which it is associated, may be treated as part of the detection zone for that floor.

6.5.2.3 Detectors protecting concealed spaces not exceeding 500 m^2 may be connected to the detection zone on the same floor, provided that the total number of detectors does not exceed 40.

6.5.2.4 Detection zones may be subdivided, such that signals from individual devices, or groups of devices, may also be indicated at the FDCIE, thus providing more detailed information on the location of an event, in addition to the indication of the affected detection zone.

6.5.2.5 Detectors displayed individually shall not be identified as separate detection zones unless representing the only detector within an enclosure.

6.5.2.6 A single detection zone shall not intersect more than one alarm zone.

6.6 Fire detector selection, sensitivity, and response

6.6.1 The type and sensitivity of detectors shall be selected to meet the design objectives for the FDAS, including the fire risk, proposed mounting height, area of coverage, and environmental conditions inside the building.

NOTE In situations where the use of smoke detectors might result in unwanted alarms, other approaches can be considered, for example:

a) relocation of the detector;

b) use of other types of detectors, including multisensor detectors. The use of heat detectors to replace required smoke detectors is not recommended but might be required in some environments;

c) use of dependency on more than one alarm signal.

6.6.2 Where the relevant part of ISO 7240 allows more than one sensitivity class or where a manufacturer has equipment that allows sensitivity settings, the sensitivity for detectors shall be specified for each detector installed in the building.

6.6.3 The FDAS response may be delayed by the use of dependency on more than one alarm signal, as specified in ISO 7240-2. Where used, the following equipment shall not be configured to use the function:

a) manual call points;

b) FDCIE connected to other FDCIE;

c) detectors installed in hazardous areas;

d) fire suppression systems;

e) line-type smoke detectors using a transmitted optical beam, where a beam-interrupt fault overrides the alarm state;

f) detection zones using static response heat detectors;

g) detection verification algorithms that will cause a subsequent delay in the detector alarm response of more than 60 s;

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h) detectors that may take more than 60 s to become functional after a reset.

NOTE Since alarm dependency delays the initiation of an alarm signal, it is important to first try other efforts to eliminate unwanted alarm signals.

6.7 Fire detector location

6.7.1 General

Detector locations and spacing shall include evaluation of room geometry and risk, such as

— ceiling height,

— ceiling structure,

— furniture,

— occupancy, and

— application (e.g. computer room).

6.7.2 Locations requiring fire detectors

6.7.2.1 General

6.7.2.1.1 The following considerations shall apply in determining the location of detectors to be installed.

a) Smoke detectors using scattered light or transmitted light (refer to ISO 7240-7, ISO 7240-15, and ISO 7240-27), or CO fire detectors and heat sensors (refer to ISO 7240-8 and ISO 7240-27) shall be installed in all sleeping areas.

b) Smoke detectors using scattered light or transmitted light shall be installed in all exits, passageways, corridors, hallways, or other similar areas that are part of a path of travel to an exit.

c) Where an area is divided into sections by walls, partitions, or storage racks, reaching within 300 mm of the ceiling (or the soffits of the joists where there is no ceiling), each section shall be treated as a room and shall include detectors.

d) A clear space of at least 100 mm radius, to a depth of 600 mm, shall be maintained from the detector or sampling point.

e) Detector alarm indicators shall be visible from the path of normal entry to the area.

f) Detectors shall be installed so that the “on” or “off” condition of the alarm indicator shall be discernible from a trafficable area.

NOTE Additional detectors might be required where any special structural features or conditions exist.

6.7.2.1.2 Where detectors incorporating more than one sensor are installed and the detector is adjusted for use with one sensor, installation requirements for the operational sensor shall apply.

6.7.2.2 Accessible service tunnels

Non-fire-isolated accessible service tunnels that provide communication between buildings or sections thereof shall have detectors installed (see also 6.7.2.8).

6.7.2.3 Air-handling systems

6.7.2.3.1 Smoke detection equipment for ducts (refer to ISO 7240-22) shall be used for monitoring air in ducts.

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6.7.2.3.2 Within air-handling systems, detectors shall be provided in the following locations:

a) *return-air system* — Buildings with a return-air-handling system serving more than one enclosure, not provided with smoke detection within the occupied space, shall have smoke detectors installed adjacent to the return/relief/economy air inlet or use smoke detection equipment for ducts to sample air from the common return air inlets.

NOTE 1 The effect of dilution might prevent operation of a common return-air detector if smoke is only entering the duct from a single return air grill.

NOTE 2 In areas where the air handling systems result in high (e.g. > 1 m/s) airflows within the enclosure (such as computer rooms and telecommunications facilities), a detector with a high sensitivity might be required to detect smoke which may not be detected by ceiling-mounted detectors.

b) *supply-air ducts* — Air-handling plant supplying air to more than one storey within the building shall have a smoke detector installed as close as practicable to the plant to detect smoke downstream from the supply air fan.

NOTE Shutting down the air-handling equipment upon the operation of any detector associated with the air-handling systems within the building will help prevent the spread of smoke throughout the building.

c) *exhaust ducts* — Ducts that are used for exhausting cooking fumes, flammable vapours, lint material, and the like shall have at least one detector at the furthest practicable downstream point of the duct.

NOTE Detectors for this application need to be carefully selected to suit the environment so that unwanted alarms are minimized. A fully sealed heat detector would normally be used.

6.7.2.3.3 Each detector mounted within an air-handling system shall be indicated as a separate detection zone at the FDCIE.

6.7.2.3.4 Detectors installed in air-handling systems shall be provided with permanent indelible labels, stating detection zone designation, affixed adjacent to the detectors.

6.7.2.3.5 Integral alarm indicators on smoke detectors located in air-handling systems shall be clearly visible. Where this condition cannot be met, remote indicators shall be installed and labelled appropriately (see 6.7.2.4.3).

6.7.2.4 Concealed spaces

6.7.2.4.1 General

6.7.2.4.1.1 Detectors shall be installed in all concealed spaces. Exemptions are provided in 6.7.3.

6.7.2.4.1.2 Access for maintenance of detectors installed within concealed spaces shall be provided. Where personnel entry to the concealed space is required, the access dimensions shall be not less than 450 mm × 350 mm.

6.7.2.4.2 Electrical equipment

6.7.2.4.2.1 Where a concealed space contains electrical lighting or power equipment that is fully within the concealed space and is connected to an electrical supply in excess of extra-low voltage, a detector shall be mounted on the ceiling of the concealed space within 1,5 m measured horizontally from the equipment. Where the mounting surface is a sloping surface, the detector shall be mounted on the high side of the equipment.

6.7.2.4.2.2 Detection is not required when light fittings are not rated above 100 W, power equipment with moving parts is not rated above 100 W, or other power equipment is not rated above 500 W.

NOTE 1 For the purpose of this part of ISO 7240, electrical wiring and any enclosures of light fittings not deemed combustible, which protrude into a concealed space, are not regarded as electrical equipment.

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NOTE 2 The detector used in the protection of the electrical equipment does not necessarily constitute protection of the concealed space.

6.7.2.4.3 Remote indicators for fire detectors

6.7.2.4.3.1 Where a detector indicator is not visible from a normally occupied area, remote indicators shall be used to indicate a detector in alarm (see 6.7.2.4.3.6 for exceptions).

6.7.2.4.3.2 Remote indicators for rooms, cupboards, or similar areas shall be installed adjacent to the door giving access to the detector(s).

6.7.2.4.3.3 Remote indicators for concealed spaces shall be installed in an accessible area as close as practicable to the detector.

6.7.2.4.3.4 Where a detector is mounted under removable flooring such as in a computer room and the detector location is not indicated at the FDCIE, a label shall be affixed to the ceiling or ceiling grid immediately above the detector indicating the location of the detector below.

6.7.2.4.3.5 A common remote indicator for multiple detectors, or multiple sampling holes of a single aspirating detector, within a single room or sole occupancy unit may be used.

6.7.2.4.3.6 Remote indicators are not required where

a) the detector location is indicated at the FDCIE, or

b) the concealed space is accessible and

   1) has a height exceeding 2 m and is trafficable by personnel, or

   2) is beneath removable flooring (such as computer flooring).

6.7.2.5 Cupboards

6.7.2.5.1 Any cupboard that has a capacity exceeding 3 m^3 shall have detectors installed. Cupboards divided by partitions or shelves into separate areas of less than 3 m^3 capacity do not require detectors.

6.7.2.5.2 Cupboards containing electrical or electronic equipment having voltages greater than extra-low voltage shall be protected internally if in excess of 1 m^3 [the requirements of 6.7.2.1.1 e) need not apply].

NOTE For electrical cubicles not requiring protection, see 6.7.3.

6.7.2.6 Intermediate horizontal surfaces

6.7.2.6.1 Protection shall be provided under intermediate horizontal surfaces such as ducts, loading platforms, and storage racks in excess of 3,5 m in width and whose under-surface is in excess of 800 mm above the floor.

6.7.2.6.2 Where the distance from the underside of the intermediate surface to the ceiling is less than 800 mm, the underside of the intermediate surface may be considered as the ceiling and does not require detectors above the intermediate surface.

6.7.2.6.3 If the side of the duct or structure is in excess of 800 mm from the wall or other ducts or structures, detectors shall be provided at the highest accessible point on the ceiling.

6.7.2.6.4 Where a concealed space is formed above or below the intermediate surface, such as ducts above false ceilings, 6.7.3 shall apply.

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6.7.2.7 Open grid ceilings

6.7.2.7.1 Detectors may be omitted from the underside of open grid portions of the ceiling which have not less than two-thirds of the total ceiling area open to the free flow of air and have detectors installed on the ceiling above the open grid.

6.7.2.7.2 Where any solid portion of the ceiling has a minimum dimension in excess of 3,5 m, 6.7.2.6 shall apply.

6.7.2.7.3 Where flame detectors are used, they shall be installed above and below the open grid ceiling.

6.7.2.7.4 The space above the open grid ceiling shall be protected, if required by this part of ISO 7240.

6.7.2.8 Restricted fire service access

Where detectors are installed in areas to which fire service access is restricted, each area shall be a separate detection zone or have a suitably labelled remote indicator installed outside the entry to the area (see Figure 1).

NOTE Examples of restricted access might include the following locked areas: shops (in arcades, malls, and plazas), vaults, strong rooms, lift motor rooms, lift shafts, cool rooms, freezers, cupboards, and electrical switch rooms.

6.7.2.9 Sole occupancy units

6.7.2.9.1 Alarm indication from each sole occupancy unit shall be

a) an individual identification at the FDCIE, or

b) a common detection zone indication at the FDCIE, provided that a remote indicator is provided adjacent to the entry to the sole occupancy unit.

6.7.2.9.2 Where a sole occupancy unit incorporating a sleeping area consists of one main room and water closet/shower/bathroom (which is not used for other purposes, e.g. laundry), one smoke detector or one multisensor detector located in the main room may be installed, provided that the total area of the whole unit is less than 50 m^2. The water closet/shower/bathroom and the ceiling space containing a fan coil unit (where installed) need not be protected.

NOTE It is important that the airflows are considered when choosing the detector location.

6.7.2.10 Stairwells

Smoke detectors using scattered light or transmitted light shall be installed within the stairwells at each floor level having access to the stairwell.

6.7.2.11 Transportable enclosures

Any enclosure with an internal volume greater than 10 m^3, that is manufactured to be transportable, used for storage or offices, and located within the building shall be protected as if part of building.

6.7.2.12 Vertical shafts and openings

6.7.2.12.1 Vertical risers, lift shafts, and similar openings between storeys that exceed 0,1 m^2 in area shall be protected within the riser at the top as follows.

a) Where vertical shafts penetrate any storey and are not fire-isolated from other areas, a detector shall be located on the ceiling of each storey not more than 1,5 m horizontally distant from where the vertical shaft that penetrates the storey above.

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b) Any ceiling that contains openings exceeding 9 m^2 and permitting free travel of fire between storeys shall have detectors located within 1,5 m of the edge of the opening and spaced not more than 7,2 m apart around the perimeter of the opening. Such detectors may be regarded as part of the general protection for the area below the opening. If the opening is less than 0,5 m from a wall, detectors are not required between the wall and the opening.

6.7.2.12.2 The requirements of 6.7.2.1.1 e) need not apply.

6.7.2.13 Additional requirements for flame detectors

6.7.2.13.1 Flame detectors shall be located so that the detector's field of view is not blocked by structural members of buildings or other objects.

6.7.2.13.2 Where flame detectors are placed in environments that are likely to lead to the depositing of particles on the lens, appropriate baffles or purging equipment shall be fitted to ensure that the detector's sensitivity range is maintained between service periods.

6.7.3 Locations not requiring detectors

Detectors are not required in the following locations:

a) *air locks* — opening on both sides into protected areas, provided that they are less than 3,5 m^2 in area, do not contain electrical equipment, are not used for the storage of goods or for access to cupboards, and are not used as washrooms;

b) *concealed spaces* — as follows

   1) less than 800 mm high, do not contain electrical lighting and power equipment, and are not used for storage,

   2) to which there is no access and that are fire-isolated with a minimum fire-resistance level 60 min,

   3) to which there is no access and that are less than 350 mm high, irrespective of construction, and

   4) less than 3 m^3, do not contain electrical lighting and power, and are not used for storage;

c) *open covered areas* — verandas, balconies, colonnades, open-sided covered walkways, overhanging roof areas, and the like and not used for the storage of goods or as a car park;

d) *cupboards containing water heaters* — if solely for the use of a water heater and not in excess of 3 m^3;

e) *exhaust ducts* — in ducts exhausting from toilets, or rooms containing single ironing and laundry facilities;

f) *areas protected with a sprinkler system*;

g) *sanitary spaces* — any water closet or shower-recess or bathroom, with a floor area of less than 3,5 m^2 and opening off a protected area;

h) *skylights* — as follows

   1) with an opening on the ceiling of less than 1,5 m^2 and not used for ventilation,

   2) installed in areas not requiring detection (such as sanitary spaces),

   3) that have less than 4,0 m^2 area, have a recess height of not more than 800 mm, and are not used for ventilation,

   4) with an opening on the ceiling of less than 0,15 m^2 (regardless whether used for ventilation or not);

i) *switchboards* — any non-recessed or freestanding switchboard or switchboard cubicle protected by detectors installed in the area within which it is contained.

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6.8 Fire detector spacing

6.8.1 Smoke detectors and carbon monoxide detectors

6.8.1.1 Point-type

6.8.1.1.1 General

The opening to the sensing element for ceiling-mounted point-type detectors shall be not less than 25 mm and normally not more than 300 mm below the ceiling, roof, or apex. For ceiling heights between 4 m and 15 m, the sensing element shall not be more than 600 mm below the ceiling roof or apex.

NOTE Where the ceiling or roof height is more than 15 m from the floor, the detector type and location might require additional engineering considerations of the smoke plume within the building environment. It is recommended that integrating type detectors, for example aspirating detectors (see ISO 7240-20) or line-type smoke detectors using a transmitted optical beam (see ISO 7240-12), be considered, with a sensitivity setting appropriate to the height being protected (see 6.8.1.2 and 6.8.1.3).

6.8.1.1.2 Spacing of detectors for level surfaces

For level surfaces, the distance from any point on the level surface to the nearest detector shall not exceed 7,2 m and the distance between any detector and the nearest detector shall not exceed 10,2 m, (see Figure 2).

Dimensions in metres

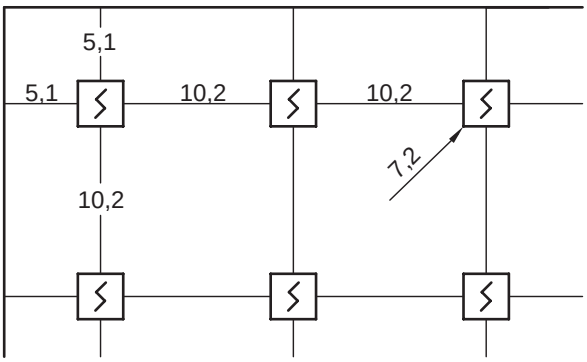

Figure 2 — Maximum detector spacing — Level surfaces

6.8.1.1.3 Spacing of detectors for sloping surfaces

Detectors shall be installed between 0,5 m and 1,5 m from the apex and spaced longitudinally at a maximum of 10,2 m between detectors. Lower rows of smoke detectors shall be no more than 10,2 m apart, measured horizontally from adjacent rows, the outside wall, or partition. The spacing between detectors within lower rows may extend to 20,4 m provided that the detectors are offset equally between the detectors on the adjacent rows (see Figure 3).

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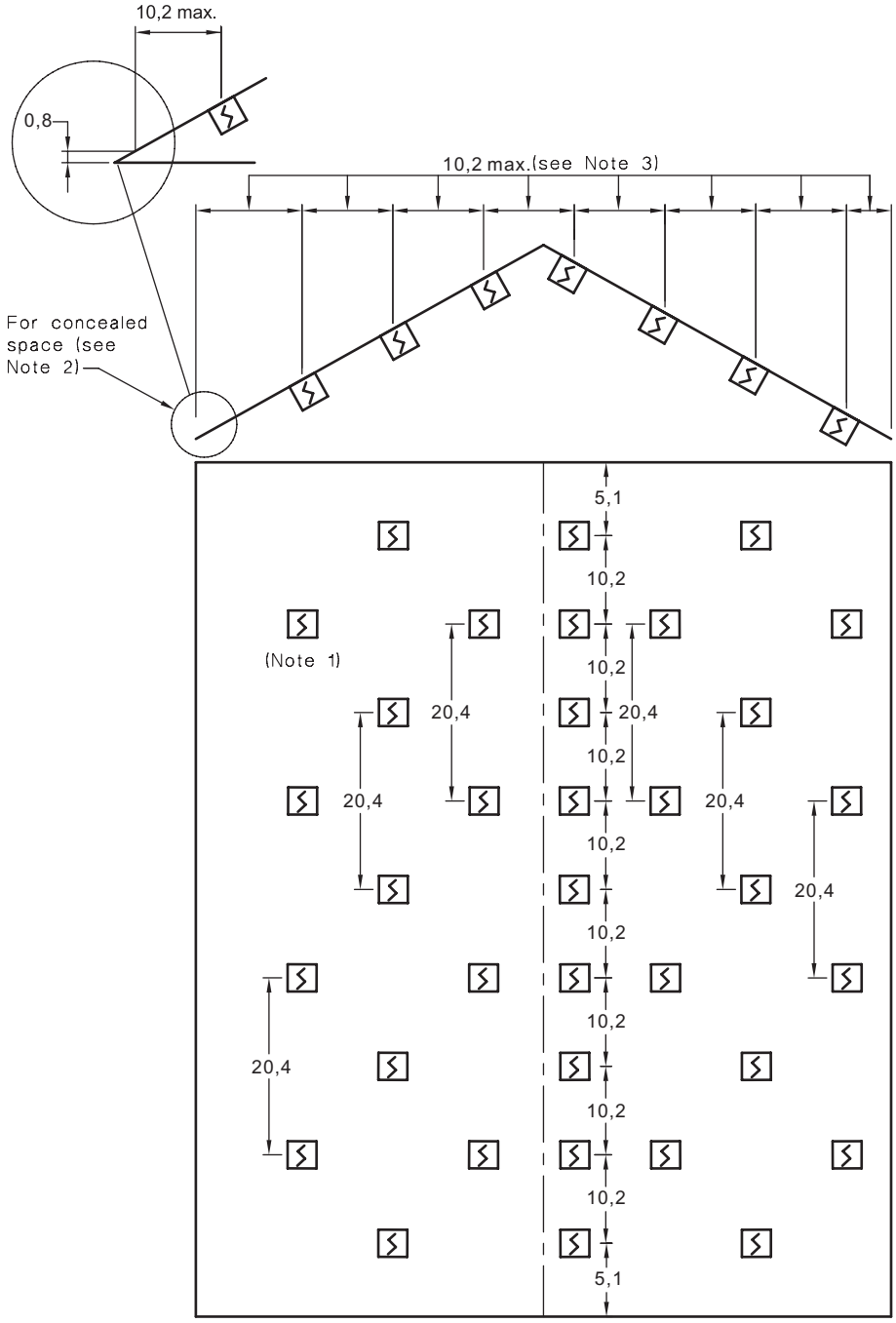

NOTE 1 Alternate rows are offset.

NOTE 2 Refer to 6.8.1.1.7 and 6.8.1.4.

NOTE 3 See 6.8.1.1.3 and Figure 6 for apex detector requirements.

Figure 3 — Example of point-type and aspirating smoke detector locations for sloping surfaces

6.8.1.1.4 Spacing from walls, partitions, or air supply openings

6.8.1.1.4.1 The distance from the nearest row of detectors to any wall or partition shall not exceed 5,1 m or be less than 500 mm (see Figure 2).

6.8.1.1.4.2 Detectors shall not be installed closer than 400 mm to any air-supply opening.

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6.8.1.1.4.3 Where ceiling fans are installed, detectors shall not be installed closer than 400 mm outside the circumference of the blades of the fan.

6.8.1.1.5 Areas of high airflows

For areas of high airflow with mechanical ventilation, such as computer rooms and clean rooms, reduced spacing of detectors shall be in accordance with Table 1.

Table 1 — Smoke detector spacing based on air-change rate

Air changes per hour	Distance between detectors (m)	Distance from walls or partitions (m)
15 – < 20	7,2	3,6
20 – < 30	6,0	3,0
30 – < 60	4,8	2,4
> 60	3,6	1,8

6.8.1.1.6 Location of smoke detectors on level surfaces with deep beams

Where level surfaces are compartmented by structural features that could have the effect of restricting the free flow of smoke, the detectors shall be located so that early detection is ensured, subject to the following.

a) For areas with the beam depth $d \leq 300$ mm (see Area 1, Figure 4), the spacing of detectors shall be in accordance with 6.8.1.1.2 and 6.8.1.1.4.

b) For areas with the ceiling height $h < 2$ m and the beam depth $d > 300$ mm (see Area 2, Figure 4), the spacing of detectors shall be in accordance with 6.8.1.1.2 and 6.8.1.1.4.

c) For areas with the ceiling height 2 m $\leq h < 4$ m, the beam depth $d \geq 300$ mm (see Area 3, Figure 4), and the interbeam area < 4 m^2, detectors shall be mounted on the underside of the beams and spaced in accordance with 6.8.1.1.2 and 6.8.1.1.4.

d) For areas such as 6.8.1.1.6 c), where the interbeam area ≥ 4 m^2, at least one detector shall be placed in each interbeam area and the spacing shall be in accordance with 6.8.1.1.2 and 6.8.1.1.4.

e) For areas with the ceiling height $h \geq 4$ m, the deep beam depth $d \geq 300$ mm (see Area 4, Figure 4), and the interbeam area < 9 m^2, detectors shall be mounted on the underside of the beams and spaced in accordance with 6.8.1.1.2 and 6.8.1.1.4.

f) For areas with the ceiling height $h \geq 4$ m, the deep beam depth $d \geq 300$ mm (see Area 4, Figure 4), and the interbeam area ≥ 9 m^2, detectors shall be placed in the interbeam areas and the spacing shall be in accordance with 6.8.1.1.2 and 6.8.1.1.4.

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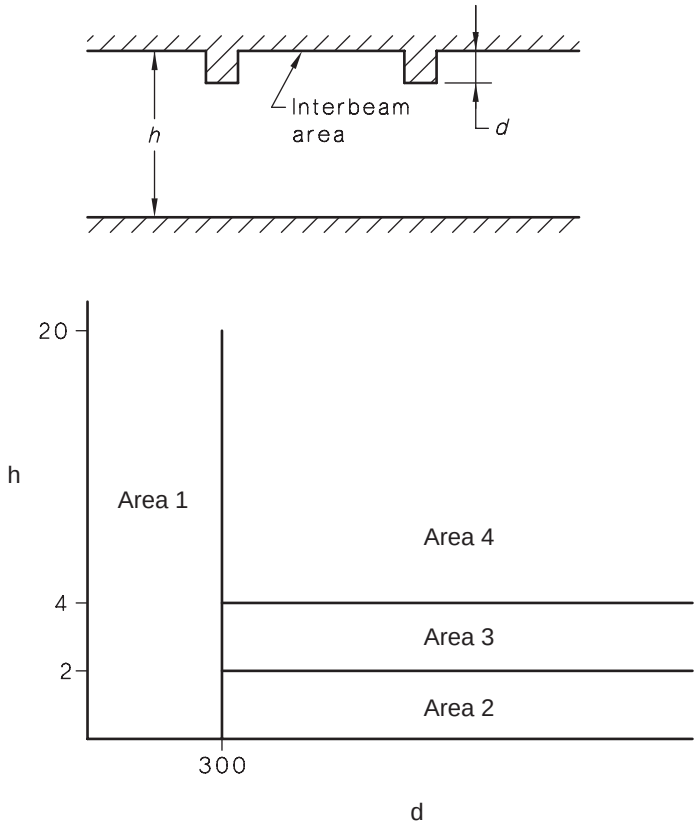

Key

h ceiling height (m)

d beam depth (m)

Figure 4 — Design criteria for point-type smoke detectors and aspirating smoke detector systems in structures with deep beams

6.8.1.1.7 Spacing in concealed spaces requiring smoke detectors

Where detectors are required in accordance with 6.7.2.4, spacing and location shall be in accordance with 6.8.1.1.2 to 6.8.1.1.6, subject to the following.

a) With level upper surfaces in excess of 2 m high, detectors shall be spaced in accordance with 6.8.1.1.2 and 6.8.1.1.4.

b) With level upper surfaces not exceeding 2 m high and having downward projections, such as beams and ducts, not exceeding 300 mm from the upper surface of the space, spacing between detectors shall not exceed 15 m and the distance between any wall or partition to the nearest detector shall not exceed 10,2 m. Where downward projections exceed 300 mm, spacing of detectors shall be in accordance with 6.8.1.1.6 b).

c) With apexes, the lowest row of detectors shall be located not more than 10,2 m measured horizontally towards the apex from a position where the vertical height, between the upper and lower surfaces of the space, is 800 mm (see Figure 3).

6.8.1.2 Aspirating smoke detectors

6.8.1.2.1 A single aspirating smoke detector (see ISO 7240-20) shall not cover an area greater than a single detection zone (see 6.5).

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6.8.1.2.2 The location of sampling holes shall be in accordance with the spacing requirements for point-type detectors (see 6.8.1.1).

6.8.1.2.3 For normal applications, a class C aspirating smoke detector shall be used.

6.8.1.2.4 For high ceiling applications (>15 m), where smoke dilution is a design consideration, a class B aspirating smoke detector shall be used.

6.8.1.2.5 For areas with high airflow (>4 m/s), a class A aspirating smoke detector shall be used for sampling at the air return vents.

6.8.1.2.6 The design of the aspirating smoke detector pipe-work and sampling hole sizes shall be in accordance with the data supplied by the manufacturer.

6.8.1.3 Line-type smoke detectors using a transmitted optical beam

6.8.1.3.1 For ceiling heights up to 40 m, line-type smoke detectors using a transmitted optical beam (refer to ISO 7240-12) shall be mounted not less than 25 mm and not more than 600 mm below the ceiling or roof.

NOTE For ceiling heights above 25 m, the sensitivity of the detectors should be set to compensate for expected increased smoke dilution caused by the likely spread of a smoke plume as a function of height from the fire source.

6.8.1.3.2 The distance between beams shall not exceed 14,4 m (see Figure 5). The maximum distance from any wall to the nearest beam shall not exceed 7,2 m.

NOTE Some beam receiver units might be unsuitable for exposure to strong light, especially direct sunlight.

6.8.1.3.3 Where detectors cannot be installed in accordance with 6.8.1.3.2 (e.g. due to the construction of the structure or absence of suitable mounting points), detectors may be installed more than 600 mm below the ceiling or roof provided that the spacing between beams is reduced to a quarter of the mounting height of the beam above the floor.

NOTE It is generally the case that hot plumes have a spreading angle of 12° - 30°. The requirement for reduced spacing of detectors takes into account the likely spread of a smoke plume as a function of height.

6.8.1.3.4 Where there is a risk that smoke may not rise to the ceiling or roof, additional detection may be provided at intermediate heights. The distance between detectors mounted at intermediate heights shall be a quarter of the mounting height above the floor.

NOTE 1 Additional line-type smoke detectors are often installed in vertical spaces at lower levels, e.g. atria.

NOTE 2 Designers might also consider mounting detectors such that the beams traverse the space at an angle to the horizontal.

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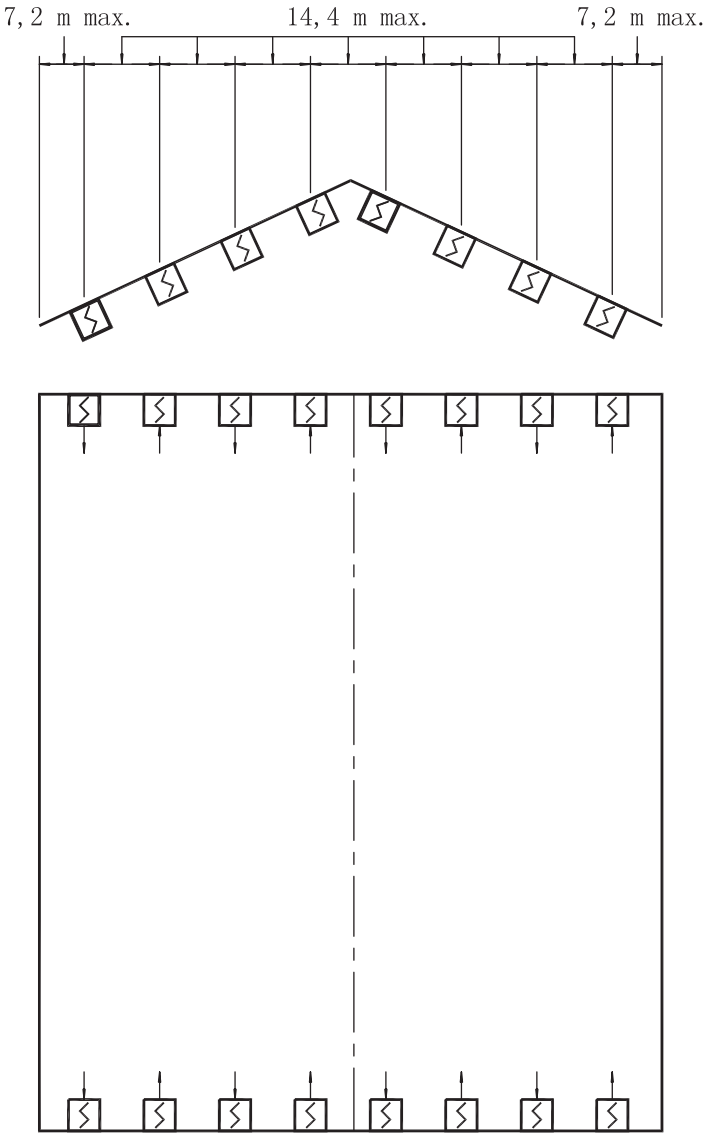

Figure 5 — Example of line-type smoke detector locations

6.8.1.4 Location of detectors near ceiling or surface apexes

Detectors shall be installed near the apex of a sloping ceiling, roof, or a surface to avoid dead air pockets (see Figure 6).

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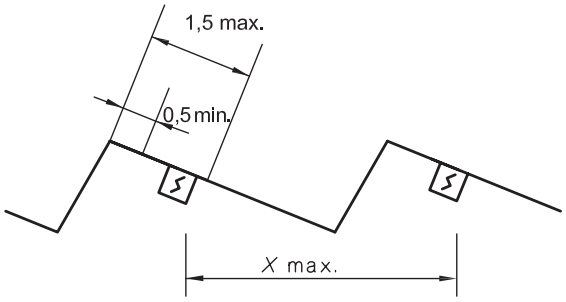
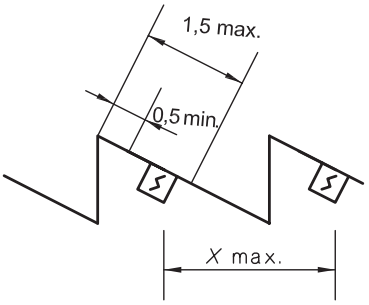
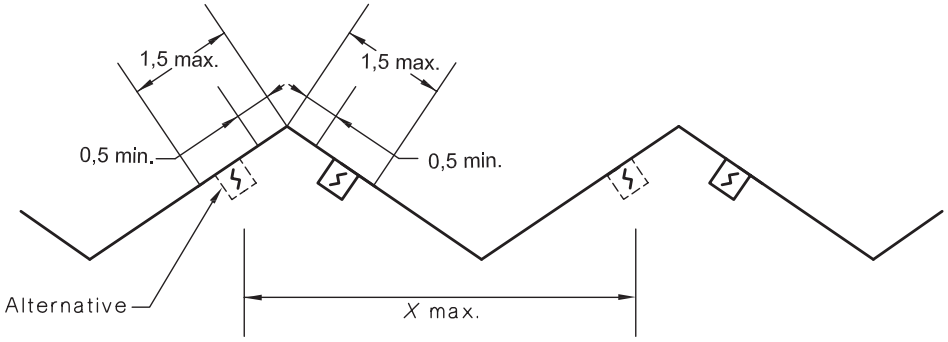


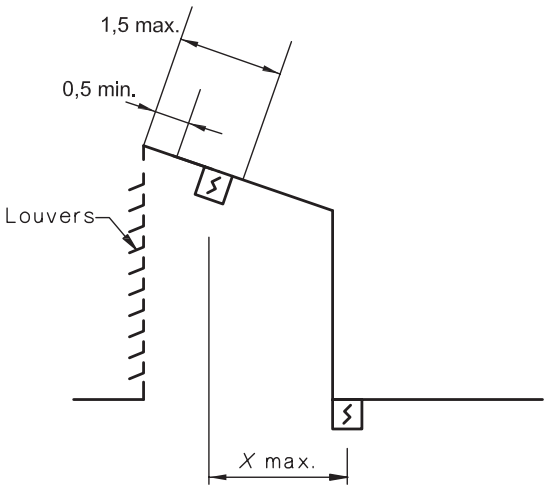
(a) Unequal sloping surface



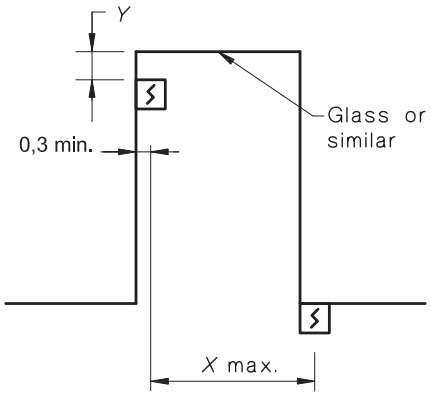
(b) Sawtooth ceiling, roof, or surface



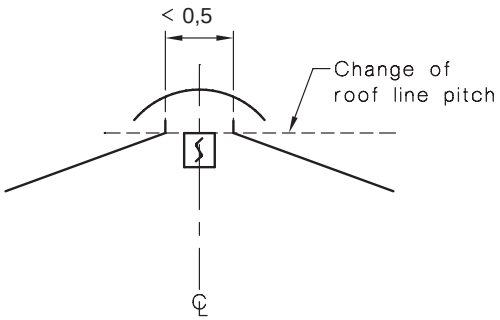
(c) Equal sloping surface



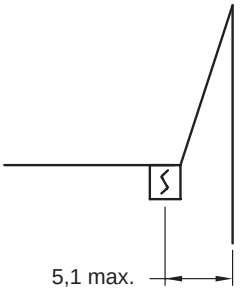
(d) Louvred ceiling or roof with louvred riser



(e) Ceiling, roof, or surface with skylight



(f) Ventilated ridge



(g) Narrow apex

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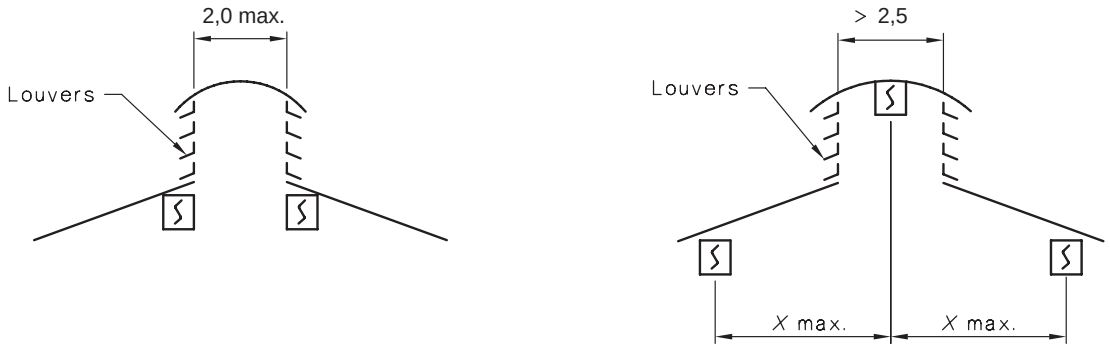

(h) Narrow ridge vent (i) Broad ridge vent

Key

X 10,2 m for point-type smoke detectors and aspirating smoke detectors, and 14,4 m for line-type smoke detectors using a transmitted optical beam

NOTE 1 For part (c), alternative location is shown using a symbol with dashed outline.

NOTE 2 Infrared scan of a building has shown heat pockets at apexes of roof structures due to solar radiation; therefore, detectors located in these pockets might not detect a fire early enough to meet the design requirements.

Figure 6 — Examples of point-type, line-type, and aspirating smoke detector locations at ceiling, roof, or surface apexes

6.8.2 Heat detectors

6.8.2.1 Point-type

6.8.2.1.1 General

Detectors shall be installed so that no part of the sensing element is less than 15 mm or more than 100 mm below the ceiling or roof. Where roof purloins inhibit the free flow of heat to the detector, the detector may be installed on the purloin provided that the sensing element is not further than 350 mm from the roof.

NOTE 1 Where the height of the ceiling is greater than 6 m, it is recommended that a detector with higher sensitivity be considered.

NOTE 2 Infrared scans of a building have shown heat pockets at apexes of roof structures due to solar radiation. Therefore, detectors located in these pockets might not detect a fire early enough to meet the design requirements.

6.8.2.1.2 Spacing of heat detectors for level surfaces

For level surfaces, excluding corridors [see 6.7.2.1.1 b)], the distance from any point on the level surface to the nearest detector shall not exceed 5,1 m and the distance between any detector and the nearest detector shall not exceed 7,2 m (see Figure 7).

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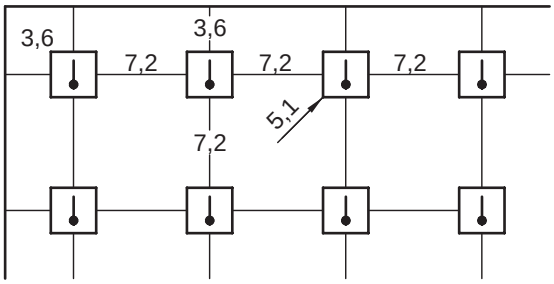

Figure 7 — Maximum heat detector spacing — Level surfaces

6.8.2.1.3 Spacing of heat detectors for sloping surfaces

6.8.2.1.3.1 Detectors shall be installed between 0,5 m and 1,5 m from the apex and spaced longitudinally at a maximum of 7,2 m between detectors. Lower rows of heat detectors shall be no more than 7,2 m apart, measured horizontally from adjacent rows, the outside wall, or partition. The spacing between heat detectors within lower rows may extend to 14,4 m provided that the detectors are offset equally between the detectors on the adjacent rows (see Figure 8).

6.8.2.1.3.2 Where the ceiling is constructed with beams or joists or a step less than 300 mm deep, the detector may be installed on the underside of the beam or joist.

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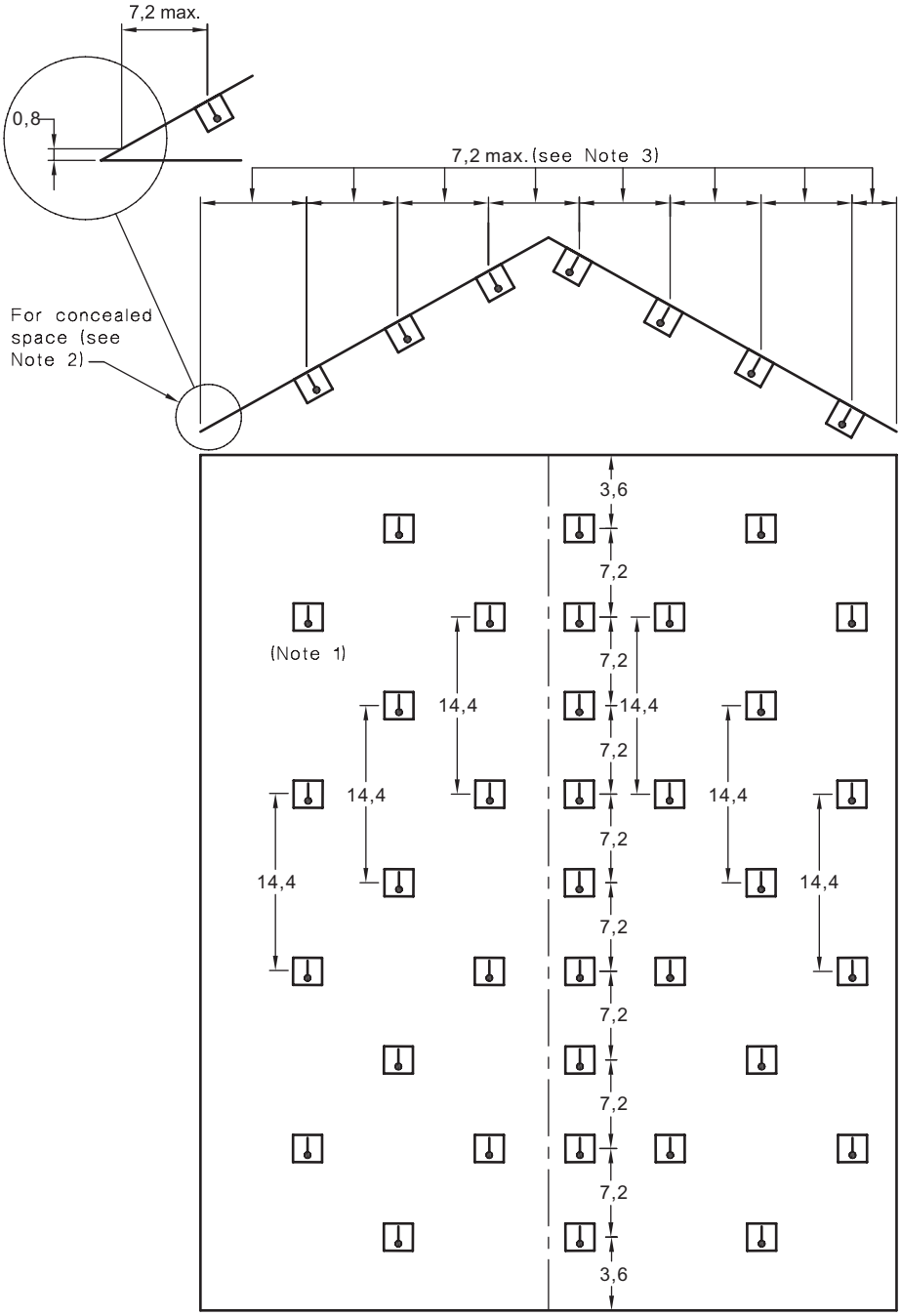
Dimensions in metres



NOTE 1 Alternate rows are offset.

NOTE 2 Refer to 6.8.2.1.6.

NOTE 3 See Figure 9 for apex detector requirements.

Figure 8 — Examples of heat detector locations for sloping surfaces

6.8.2.1.4 Spacing from walls, partitions, or air supply openings

6.8.2.1.4.1 The distance from the nearest row of detectors to any wall or partition shall not exceed 3,6 m or be less than 300 mm (see Figure 7).

6.8.2.1.4.2 Detectors shall not be installed closer than 600 mm to any air supply opening.

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6.8.2.1.5 Reduced spacing

Where the ceiling is segmented by beams, joists, or ducts and the vertical depth of such members is greater than 300 mm, spacing between detectors shall be reduced by 30 % in the direction perpendicular to the direction of segmentation.

6.8.2.1.6 Spacing in concealed spaces requiring heat detectors

Where detectors are required in accordance with 6.7.2.4, spacing and location shall be in accordance with 6.8.2.1.2 to 6.8.2.1.5, subject to the following.

a) With level upper surfaces in excess of 2 m high, detectors shall be spaced in accordance with 6.8.2.1.2 and 6.8.2.1.4.

b) With level upper surfaces less than 2 m high and having downward projections, such as beams and ducts not exceeding 300 mm from the upper surface of the space, the spacing between detectors shall not exceed 10,4 m, and the distance between any wall or partition to the nearest detector shall not exceed 5,1 m.

c) Where downward projections exceed 300 mm, the spacing of detectors shall be in accordance with 6.8.2.1.2 and 6.8.2.1.4.

d) With apexes, the lowest row of detectors shall be located not more than 7,2 m measured horizontally towards the apex from a position where the vertical height, between the upper and lower surfaces of the space, is 800 mm (see Figure 8).

6.8.2.2 Line-type heat detectors

Installations of line-type heat detectors shall comply with the appropriate requirements of 6.8.2.1.2 to 6.8.2.1.5 and with the following requirements.

a) The maximum area covered by each line-type heat detector shall be in accordance with the detection zone limitation specified in 6.5.2.

b) The line-type heat detector sensing elements shall be installed so that they are not subject to mechanical damage.

c) The heat-sensing portion of the line-type heat detector shall not be installed in more than one detection zone unless adequate precautions are taken to prevent incorrect detection zone identification and ensure that a single fault does not affect more than one detection zone.

d) The line-type heat detection circuits shall be disposed throughout the area so that there is not more than 7,2 m between any two adjacent lines and within 3,6 m of any wall or partition.

e) A sensing element shall be installed in the roof bay of each apex, even though these apexes may be less than 7,2 m apart.

f) Where a line-type heat detector is made up of a number of individual elements, each element shall be considered as a point-type detector for spacing purposes.

6.8.2.3 Location of heat detectors near ceiling or surface apexes

Detectors shall be installed near the apex of a sloping ceiling, roof, or a surface but shall avoid natural hot spots and dead air pockets (see Figure 9).

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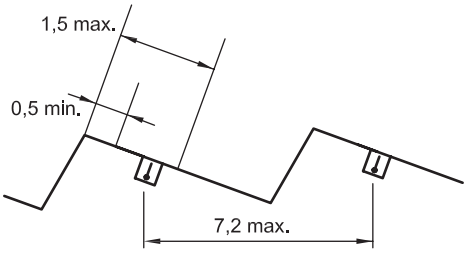
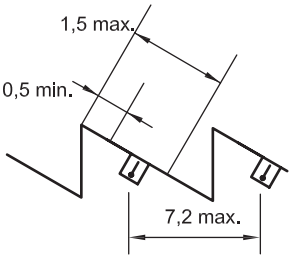
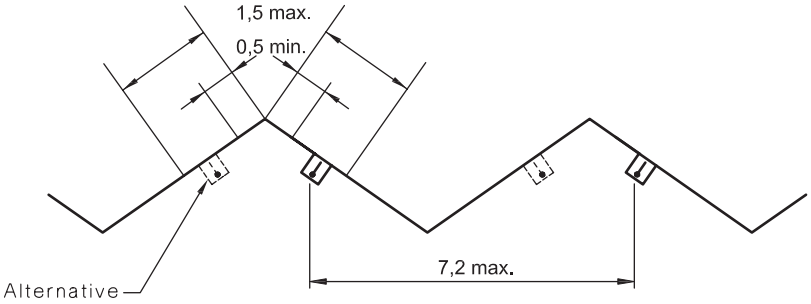
Dimensions in metres



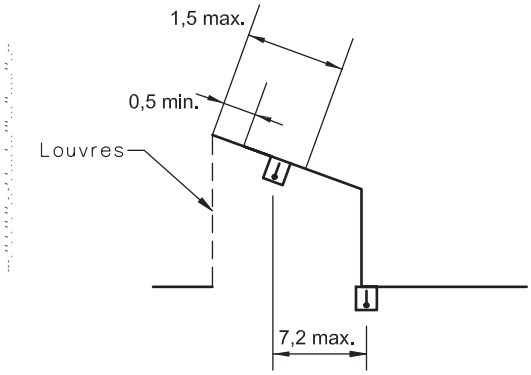
(a) Unequal sloping surface



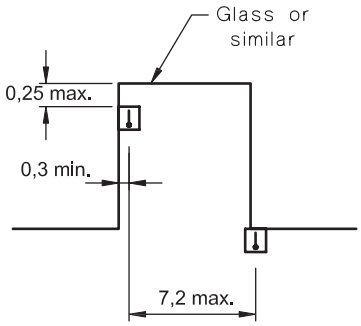
(b) Sawtooth ceiling, roof, or surface



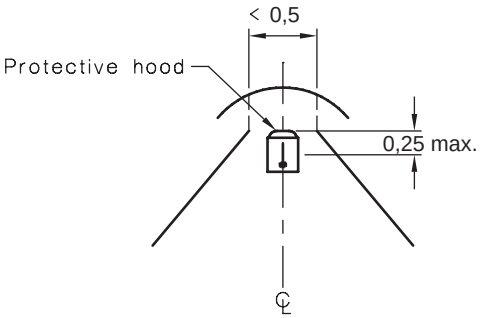
(c) Equal sloping surface



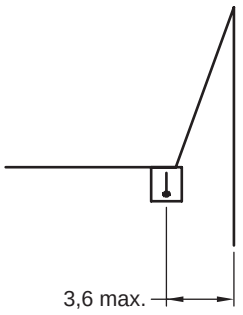
(d) Louvred ceiling or roof with louvred riser



(e) Ceiling, roof, or surface with skylight



(f) Ventilated ridge



(g) Narrow apex

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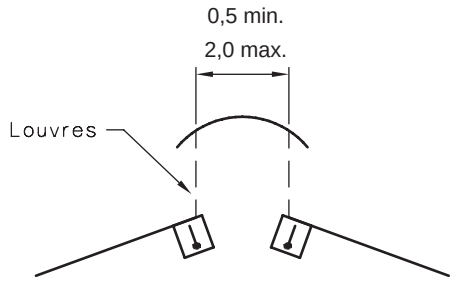
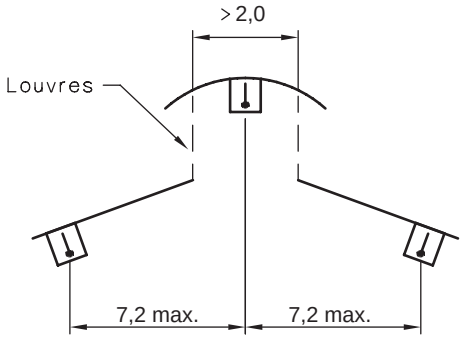


(h) Narrow ridge vent



(i) Broad ridge vent

Figure 9 — Examples of point-type and line-type heat detector locations at ceiling, roof, or surface apexes

6.8.3 Flame detectors

Flame detectors (refer to ISO 7240-10) shall be spaced to ensure that the risk areas are protected with a minimum of shadowing or blind spots. Where significant unprotected areas exist because of the presence of objects such as aircraft, equipment, or storage racks, additional detectors to cover these areas shall be installed.

NOTE The operating principles of flame detectors (infrared or ultraviolet) need to be understood to enable the correct selection and location of a particular device to suit the risk and the level of protection required. The manufacturer's installation instructions provide important information for the type of detector selected.

6.8.4 Multisensor detectors

6.8.4.1 Where multisensor detectors are installed (e.g. ISO 7240-8, ISO 7240-15, and ISO 7240-27) and only the heat-sensing element is enabled, detectors shall be installed in accordance with the requirements for heat detectors and comply with the sensitivity requirement of ISO 7240-5.

6.8.4.2 Where the detector response settings can be varied, these settings shall be set within the limits specified in the relevant equipment standards.

6.9 Manual alarm condition initiation

6.9.1 A manual call point complying with ISO 7240-11 shall be installed in a clearly visible and readily accessible location adjacent to each exit from each floor of the building.

6.9.2 Where the manual call point is installed on the outside of the exit door, it may be connected to the detection zone associated with the floor of the building.

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6.9.3 The maximum distance of travel to any manual call point shall not exceed 45 m.

NOTE Where the distance of travel exceeds 45 m and an additional manual call point is required to be installed, the location requirement of 6.9.1 need not apply.

6.9.4 Manual call points shall be installed at a height of (1,4 ± 0,2) m from the trafficable area, with a clear space of 0,6 m semi-circle around the front face of the manual call point.

6.10 Fire alarm devices

6.10.1 General

Alarm zones may include more than one detection zone.

6.10.2 Audible alarm

6.10.2.1 Audible warning shall be provided to alert all building occupants to a fire alarm condition.

6.10.2.2 The alarm system shall be one of the following:

a) a sound system for emergency purposes in accordance with ISO 7240-19, initiated by the FDAS; or

b) audible alarm devices complying with ISO 7240-3 (with or without verbal message).

6.10.2.3 Where an FDAS is connected to a sound system for emergency purposes complying with ISO 7240-19, a disable facility shall be provided to allow the FDAS to be tested without initiating operation of the fire alarm system.

6.10.2.4 Where audible alarm devices complying with ISO 7240-3 are used, the following shall apply.

— The evacuation signal shall operate simultaneously throughout the building.

— The alarm signals shall be audible in all places specified in ISO 7240-19.

— The A-weighted sound pressure level during the “on” phases of the alarm signal, measured with the time-weighting characteristic F (fast) (see IEC 61672-1), shall comply with the following:

  — the requirements of ISO 8201;

  — exceed by a minimum of 10 dBA the ambient sound pressure level averaged over a period of 60 s, not be less than 65 dBA, and not more than 105 dBA. These values shall be determined in accordance with IEC 61672-1;

NOTE 1 It is suggested that the default evacuation signal complying with ISO 8201 consists of a uniformly increasing frequency during the 0,5 s “on” phase of the signal. Other signals might be more appropriate for use where the ambient noise masks the signal.

NOTE 2 It is important to take consistent measurements such as at the normal standing positions on the floor of coverage.

— The audible alarm devices shall be connected to a supervised output at the FDCIE.

— A single fault in one detection zone shall not affect the operation of audible alarm devices in other detection zones.

6.10.2.5 If the audible alarm signal is intended to arouse sleeping occupants, the minimum A-weighted sound pressure level of the signal shall be 75 dBA at the bedhead, with all doors closed.

NOTE 75 dBA might not be adequate to awaken all sleeping occupants.

6.10.2.6 Where occupants, such as patients in hospital wards, must not be subject to possible stress imposed by loud noises, the sound pressure level and message content shall be arranged to provide warning for the staff and minimize patient trauma.

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6.10.3 Visual alarm

6.10.3.1 Internal indication

6.10.3.1.1 The alarm system shall include visual alarm devices complying with ISO 7240-23 installed in the following areas of the building:

— where the ambient noise exceeds 95 dBA;

— where hearing protection is normally used by building occupants;

— normally occupied by people with a hearing disability; or

— in buildings in which the initial warning of fire may be restricted to designated occupants (e.g. hospital operating theatres and certain public assembly buildings).

6.10.3.1.2 Visual alarm devices shall be installed on the ceiling or wall, in sufficient numbers such that the visual signal is visible from normally accessible locations throughout the required area in the highest expected ambient light condition. When installed on the wall, the minimum height shall be 2,4 m from the trafficable area.

6.10.3.1.3 Where more than two visual alarm devices are simultaneously visible by building occupants, they shall flash in synchronization (see ISO 7240-23).

6.10.3.1.4 A single fault in one alarm zone shall not affect the operation of visual alarm devices in other alarm zones.

6.10.3.2 External indication

6.10.3.2.1 The FDAS shall operate one type-B red-coloured visual indicator complying with ISO 7240-23 to indicate a fire alarm condition. The visual indicator shall be located on the outside of the building, be visible from the main approach to the building, and be as near as practicable to the designated entry point.

6.10.3.2.2 The word “FIRE” shall be marked on or adjacent to the visual indicator in lettering not less than 25 mm in height on a contrasting background. The lettering shall be upright and clearly legible when the visual indicator is installed.

6.10.3.2.3 The visual indicator shall be connected to a supervised output on the FDCIE.

6.11 Fire detection control and indicating equipment

6.11.1 General

The FDCIE shall comply with ISO 7240-2.

6.11.2 Location

Indicator panels shall be installed in approved locations complying with the following requirements.

a) FDCIE shall be installed such that indications of required functions are available to the operator.

b) Access to the controls and indicators shall not be obstructed.

c) Operation of the FDAS shall not obstruct the evacuation of the building.

d) FDCIE shall be located in an area that presents a low risk of damage to the equipment and injury to personnel in an emergency, with minimum clearance in front of the FDCIE (width and depth) of 1 m (see Figure 10).

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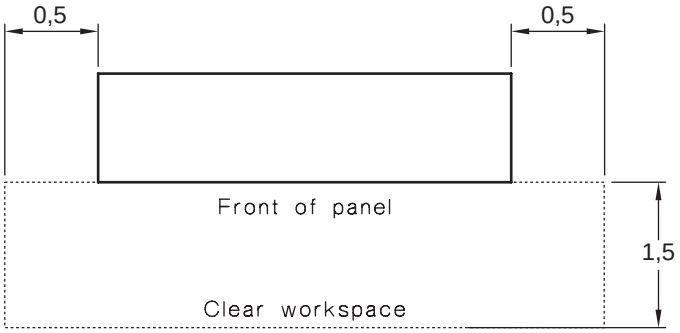

Figure 10 — Minimum enclosure clearance

e) Required controls and indicators shall be not less than 750 mm and not more than 1 850 mm above floor level.

f) Workspace for operational personnel shall be arranged so as to minimize distraction by peripheral activities.

g) Ambient light level in the vicinity of the FDCIE shall be such that visual indications can be clearly seen, controls easily operated, and any instructions or legends easily read.

h) The area shall be free of ignition sources and stored combustible materials.

i) Where FDCIE shares a common cabinet with FACIE complying with ISO 7240-16, controls shall be located such that they can be used by separate individuals, unless the controls are common to both equipment, as permitted by ISO 7240-16.

6.11.3 Covering door

6.11.3.1 Where indicators are obscured by a door, then the door shall be marked in a contrasting colour to the general colour scheme with the words "FIRE PANEL" or similar in letters not less than 50 mm high. The door shall not be lockable.

6.11.3.2 Where the door reduces the FDCIE sounder sound level below the requirement specified in ISO 7240-2, means shall be provided to give the required sound level outside the covering door.

6.11.4 Distributed FDCIE

Distributed FDCIE serving other than the detection zone(s) in which it is installed shall be installed in an area that is free from ignition sources and stored combustible materials.

6.11.5 Networked FDCIE

Where parts of FDCIE are installed in separate cabinets and in locations remote to the main indicators and controls, the following shall apply:

— a single fault in the transmission paths between parts of FDCIE shall not prevent an alarm from other parts of FDCIE;

NOTE 1 Separate cable paths (e.g. loop wiring configuration) to parts of FDCIE might provide a solution.

— a single failure of a part of FDCIE installed in a location remote to the main indicators and control shall not inhibit the correct operation of other parts of FDCIE.

NOTE 2 Compliance with this requirement might prevent the connection of parts of FDCIE in a single spur configuration.

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6.12 Power supply

6.12.1 Power supply equipment

Power supply equipment for the FDCIE shall comply with the requirements of ISO 7240-4.

6.12.2 Main power source

The power supply equipment shall be energized by a reliable source of supply and shall be connected in accordance with national electrical wiring requirements. The main power source shall be either

a) an AC supply from an electricity supply company, or

b) a source of quality and reliability equivalent to that in 6.12.2 a).

6.12.3 Standby power source

6.12.3.1 In the event of loss of the main power source, the standby power source standby time shall comply with requirements of local regulations. Where local regulations do not exist, the standby power source shall power the FDAS for a minimum of 24 h in quiescent condition, followed by a further period in the alarm condition. The alarm condition period shall be the greater of 30 min or the time required to evacuate the premises.

6.12.3.2 Annex A provides example calculations for battery capacity, charging current, and power source. When calculating the capacity of the power supply, any ancillary loads powered by the power supply equipment shall be included.

6.12.4 Batteries

Batteries shall be located and installed in accordance with the manufacturer's recommendations. Batteries shall be provided with adequate ventilation and protected against corrosion and the dangers resulting from any gases emitted by the batteries.

6.12.5 Battery cabinets

6.12.5.1 The battery and cabinet shall be readily accessible for inspection.

6.12.5.2 Battery cabinets shall be accessible by persons having specific responsibility for safety and who are competent and authorized to operate the FDCIE.

6.12.5.3 For non-sealed batteries, the battery enclosure shall not be mounted above the FDCIE enclosure.

6.12.5.4 The connecting leads to the battery shall be clearly labelled to reduce the possibility of reverse connections to the battery. The battery shall not be tapped for intermediate voltages and all connections shall be made using suitable connectors.

6.13 Fire suppression systems

6.13.1 The alarm output from a fire suppression system shall be indicated as a separate detection zone on the FDCIE.

6.13.2 Where flow switches or pressure switches, and the like, associated with fire suppression systems are used to initiate a fire alarm signal at the FDCIE, each shall be indicated as a separate detection zone on the FDCIE. Wiring to these devices shall be supervised.

NOTE Where the FDCIE does not provide adequate alarm delay facilities, the flow/pressure switches used might incorporate time delay devices to prevent unwanted alarms due to surges in the water supply.

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6.13.3 Where the FDAS is used to initiate automatic fire protection equipment, and manual control is required, fire protection control equipment complying with ISO 7240-28 shall be installed to interface the FDCIE to and control and monitor the activation of, the fire protection equipment.

6.14 Smoke and heat control

6.14.1 General

Where a smoke and heat control system is required in the building, the FDAS shall be connected and transfer alarm condition signals to initiate operation of the smoke and heat control system [see ISO 21927 (all parts)].

NOTE Equipment complying with ISO 7240-28 might be used for the control of smoke and heat control systems.

6.14.2 Smoke and fire door release control

6.14.2.1 Smoke detectors or CO fire detectors shall be installed on both sides of a fire control or smoke control door, in line with the centre of the door opening no less than 300 mm and no more than 1,5 m horizontal distance from the opening.

6.14.2.2 Smoke and fire doors held open by door hold-open devices shall close upon an alarm from the detectors installed on either side of the door.

6.14.2.3 Detectors installed to release fire and smoke control doors in a corridor on a single level may be connected to a common detection zone, together with other detectors in the same corridor.

NOTE Equipment complying with ISO 7240-28 might be used for the control of smoke and fire doors.

6.14.2.4 A manual control shall be provided for door hold-open devices. The manual control shall be located adjacent to the doors, mounted at a height not exceeding 1,6 m from the floor, and visible and accessible with the door(s) in the open position. The manual control shall be labelled “DOOR RELEASE” unless it is integral with the hold-open device. The lettering height shall be a minimum of 5 mm and in a contrasting colour to the manual control housing.

6.14.2.5 Where more than one door panel is fitted to one opening, then one switch shall release all door panels.

NOTE In some situations, a door release delay might be required to ensure the safe operation of the door.

6.15 Remote monitoring

6.15.1 Where required by the regulatory authority, the FDAS shall be connected to a monitoring service provider using routing equipment complying with ISO 7240-21.

NOTE Remote monitoring might be required by regulatory authorities for buildings for certain uses (e.g. hospitals, sleeping accommodation, chemical manufacturing), of certain construction (e.g. type of building materials), or of certain orientation (e.g. size of fire compartments, building footprint, building height, distance to adjacent structures).

6.15.2 Routing equipment shall be compatible with fire alarm and fault warning receiving station equipment.

6.16 Ancillary services

Circuits controlling ancillary devices, such as input/output devices complying with ISO 7240-18, shall be either electrically isolated, fuse protected, or current-limited to prevent a fault on the transmission path from ancillary control facilities inhibiting the operation of other FDCIE functions or the transmission of an alarm signal.

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6.17 Delays to outputs

6.17.1 Outputs from the FDAS may be delayed to provide time to investigate the cause of a fault or alarm condition.

6.17.2 Actions to be taken in the event of a delay to an output shall be included in the emergency management plan.

NOTE Designers might consider the following:

— the pattern of evacuation expected in case of fire, and how the pattern will depend on the position of the fire;

— the expected occupancy of the building, and how occupancy may vary with time or day;

— how the occupants will be informed or pre-warned of the fire condition;

— the requirements for indicating the fire location;

— how the building should be divided into detection zones and alarm zones;

— in large or interconnected buildings (such as shopping malls), with a hierarchical system or multiple control stations, the arrangements needed for transfer of control between control stations;

— how the fire brigade will be called and the information required upon arrival;

— any special facilities needed for the fire brigade;

— the special provisions for reducing the effects of unwanted alarms;

— the changes in the fire alarm response strategy between night and day, or between working and non-working days;

— the provision for emergency power supplies;

— the parts of the FDAS required to remain operational for a significant time after the initial detection of fire (e.g. alarm devices).

6.18 Transmission paths

6.18.1 Separation from other systems

6.18.1.1 The wiring of the FDCIE shall be separate from lighting and other power circuits.

6.18.1.2 The wiring shall be dedicated to the FDAS, except that the wiring may be shared with systems complying with other parts of the ISO 7240, provided that the wiring complies with the most onerous requirements of the relevant part of ISO 7240.

6.18.2 Supervision of transmission paths

6.18.2.1 Transmission paths from the FDAS

The transmission paths between the FDAS and other systems (e.g. fire alarm system, fire suppression system, smoke and heat control systems) shall be supervised for faults in accordance with ISO 7240-2.

6.18.2.2 Transmission paths within the FDAS

The transmission path between the FDCIE shall be supervised for faults in the transmission paths and

— power supply equipment,

— detectors,

— other initiating devices,

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— alarm devices,

— routing equipment, and

— networked equipment forming part of the FDAS installed separately to the FDCIE.

6.18.3 Wiring type

6.18.3.1 Wiring conductors shall be stranded and insulated. Wiring shall be such that it provides or is provided with sufficient mechanical strength to maintain the integrity of the transmission path within the expected environment.

NOTE Two core cables used for extra-low voltage with a minimum cross-sectional area of 0,75 mm^2 for each conductor might be satisfactory for general installations. Cables having more than two cores used for extra-low voltage with a cross-sectional area of not less than 0,4 mm^2 for each conductor might also be satisfactory for general information.

6.18.3.2 The maximum voltage drop shall not cause any equipment to be operated at a voltage less than the minimum specified by the equipment manufacturer.

6.18.3.3 Notwithstanding the above requirements, other communication methods such as optical fibres are permitted provided that the integrity of the installation is equivalent to the requirements of this part of ISO 7240 and such circuits are dedicated to the fire protection functions of a building.

6.18.4 Marking

6.18.4.1 For extra-low voltage transmission paths not installed within cable conduit, the outer sheath of a cable shall be coloured red or have permanent red markers of at least 25 mm in width spaced at intervals of not more than 2 m along the cable length.

6.18.4.2 The installation of each conductor shall be permanently coloured so that each conductor is readily identifiable at each termination.

6.18.4.3 Mains wiring for the FDAS shall be connected to a separate isolator (e.g. fuse or circuit breaker) at the electrical switchboard. The isolator shall be marked “Fire Alarm. Do Not Switch Off.” in lettering with a minimum height of 5 mm.

6.18.5 Wiring protection

6.18.5.1 Installation wiring shall be installed in conduit or supported on cable trays or catenary cables, suitably fastened and insulated from the wiring of other systems.

6.18.5.2 The following wiring systems, including cables, joints, terminations, and fixing mechanisms, shall be rated to withstand fire for 30 min in accordance with IEC 60331-23 for electrical transmission paths, IEC 60331-25 for optical fibres, or such higher rating as required by national requirements, and shall have a mechanical rating protection suitable for the hazard depending on where it is installed:

a) transmission paths between the FDCIE and power supply equipment, except where the equipment is in the same room and not separated by more than 2 m;

b) transmission paths between distributed parts of the FDCIE;

c) transmission paths between the FDAS and the fire alarm system, except where the equipment is in the same room and not separated by more than 2 m;

d) transmission paths that traverse any fire compartment to service another fire compartment;

e) transmission paths that traverse any detection zone to service another detection zone.

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6.18.6 Joints and terminations

6.18.6.1 Joints and terminations shall be made in a suitably labelled enclosed terminal box employing fixed terminations rated not less than the cable.

6.18.6.2 Joints and terminations associated with vertical riser cables shall be made within the associated fire-isolated duct.

6.18.7 Effect of faults on detection zones

The wiring shall be arranged such that a single short circuit or open circuit in a cable within a detection zone shall not affect the normal operation of any other detection zone.

NOTE This requirement applies to both non-addressable device wiring and addressable device wiring. In the case where a single cable is used for more than one detection zone (such as with an FDAS using addressable devices), separate cable paths (e.g. loop wiring configuration) and the use of short-circuit isolators complying with ISO 7240-17 might be considered.

6.18.8 Radio links

The design may include the use of radio links (refer to ISO 7240-25) for the connection of devices to the FDCIE.

6.19 Documentation

6.19.1 The designer shall prepare the following documentation:

a) plans of the building that show the location of
   - designated entry point(s),
   - FDCIE,
   - power supply equipment,
   - fire alarm system (if installed),
   - FDAS cabling routes and termination points,
   - detectors,
   - visual alarm devices,
   - audible alarm devices,
   - manual call points,
   - other equipment forming part of the FDAS;

b) where the FDAS protects more than one building on a site, a plan of the site identifying designated entry point(s) for each building and a site entry point;

c) water- and fade-resistant detection zone block plan of the installation, securely mounted adjacent to the FDCIE and displayed in the correct orientation of the building, showing the following:
   - the layout of the building in which the FDAS is installed;
   - the area covered by each detection zone;
   - the year of original installation and the date of the latest revision to the block plan;
   - the location of any other FDCIE, including FACIE;

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- — the location of any smoke and heat control panels;
- — the location of any fire suppression system controls;
- — the location of the electrical switchboard;

d) emergency management plan incorporating

- — the type of emergencies considered,
- — an evacuation plan for the relevant types of emergency,
- — actions to be taken in the event that there is a delay to an output from the FDAS,
- — contingencies to be taken in the event that it is necessary to change the plan,
- — who has responsibility for access to the FDAS, including who can
  - — switch off parts of the FDAS,
  - — undertake routine tests,
  - — undertake service, and
  - — undertake changes to the FDAS;

e) any assumptions made and justifications for the design solution;

f) contingency measures to take in the event that an evacuation is required during system maintenance;

g) FDAS operating manuals, including equipment documentation, in accordance with ISO 7240-2;

h) list of components and subassemblies;

i) list of component compatibility;

j) list of service items;

k) service requirements;

l) operational instructions for the operation of the FDAS, including actions to take in accordance with established and well-rehearsed procedures.

Operational instructions shall be provided in the form best suited to the environment in which they are used. This may take the form of a bound document, or laminated cards, or both, or some other means. As far as possible, graphic illustrations should be used. Where text is necessary, it should be clearly legible and in the preferred language(s).

The number of copies of the operational instructions required varies, but as a guide, there should be one copy for every control position, one copy for every equipment rack location, one copy for the purchaser's archive, one copy for the installer's archive, and one copy for the designer's archive.

6.19.2 A copy of the documentation shall be made available to the building owner or authority approving the design.

7 Installation

7.1 Responsibility

7.1.1 Installation of the FDAS shall be undertaken by a suitable installer. The installation shall comply with the design plan and shall also include the following:

a) indication of other works that can also be occurring in the building;

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b) resources available to the installer;

c) availability of equipment and materials.

7.1.2 Where the installer encounters problems with the design (e.g. due to changes in the building plan or a flaw with the design), the designer shall review the design and make any required changes. Any changes to the design or installation plan shall be approved by the owner and the relevant authority.

7.2 Qualifications

The installation of the FDAS shall be undertaken by persons having qualifications and/or experience relevant to the scope of the particular installation requirements.

NOTE National regulations might exist for the registration and recognition of individuals with the requisite qualifications and experience. The recognition might form part of a recognized competency framework.

7.3 Certification

Conformity of the installation to the design documentation shall be assessed and certified upon completion of the installation. This certification should confirm the correct installation of the components of the FDAS in accordance with the design documentation.

NOTE The owner or the relevant authority might require assessment by an independent party.

8 Commissioning

8.1 Responsibility

Commissioning of the FDAS shall be undertaken by a suitable commissioner.

8.2 Qualifications

The commissioning of the FDAS shall be undertaken by persons having qualifications and/or experience relevant to the scope of the particular commissioning requirements. Experience may include

— engineer or technician with proven experience in the field of fire detection technology,

— experienced consulting company, or

— experienced installer.

NOTE National regulations might exist for the registration and recognition of individuals with the requisite qualifications and experience. The recognition might form part of a recognized competency framework.

8.3 Procedure

8.3.1 General

8.3.1.1 A commissioning plan shall comply with the requirements in this part of ISO 7240 and any amendments incorporated as part of the design plan.

8.3.1.2 The commissioning plan shall be approved by the owner and the relevant authority.

The commissioning plan should include equipment and system checks and tests to ensure the FDAS is installed and operating correctly. The following may be included:

— Location, identification, correct type and operation of detectors, MCPs, and other devices are functional.

— Correct information is available at the FDCIE when devices are activated.

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— Transmission paths provide adequate signal and power integrity, and have been installed in accordance with requirements.

— Operation of alarm and fault signalling received by a monitoring service provider are correct.

— Actual power consumption will ensure the FDAS complies with the required standby time.

— All ancillary functions (inputs and outputs) function correctly.

— Documentation (see 6.19) are correct and available.

8.3.2 Standby power source

When tested after 24 h of quiescent operation and the period required to evacuate the premises, which shall in no case be less than 30 min, the performance of the FDAS under standby power source operation shall not cause any loss of operational functions.

8.4 Report

A report shall be prepared in accordance with the commissioning plan and shall include the following:

— building or site name;

— address;

— building owner;

— date(s) of commissioning tests;

— person(s) and company performing the commissioning tests;

— results of the commissioning tests, including

  — compliance with the design requirements specified in this part of ISO 7240 (i.e. ISO 7240-14:2013),

  — activation of each initiating device to cause an alarm condition,

  — interface tests to other systems (e.g. separate fire alarm systems, fire suppression systems, smoke and heat control systems, etc.), including fault and alarm conditions, as appropriate.

8.5 Certification

8.5.1 Conformity of the installation to the design documentation shall be assessed and certified upon completion of the commissioning.

8.5.2 This certification should confirm the correct operation of the FDAS in accordance with the design objectives.

NOTE The owner or the relevant authority might require assessment by an independent party.

9 Approvals

The FDAS shall be certified for compliance with this part of ISO 7240 and other International Standards as appropriate by an independent party acceptable to the regulatory authority.

10 Normal use

10.1 Access to system

Access to the FDAS shall be in accordance with the emergency management plan.

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10.2 Other responsibilities

Operation instructions shall be updated after additions to or modifications of the FDAS or on the basis of practical experience or revised procedures.

10.3 Routine tests and regular controls

10.3.1 Test the operation of the emergency management plan at intervals not exceeding 12 months. This should include the evacuation of the building occupants and may be undertaken in conjunction with the relevant authorities.

10.3.2 Staff training should take place at regular intervals and should include the use of all manual controls (where fitted).

10.3.3 The operation of the emergency management plan shall be performed by a competent person.

10.4 Records

10.4.1 A record shall be maintained of the operation of the FDAS, any faults, and routine tests.

10.4.2 The record may be part of the log maintained to record service events (see 11.3) and shall be readily available in the building.

10.5 Operating instructions

Operating instructions shall be located in or adjacent to the FDCIE and shall describe

— how to operate the FDAS in normal operation, alarm operation, and fault operation,

— the alarm organization as specified in the emergency management plan, and

— the names of persons assigned certain tasks.

11 Service

11.1 Responsibility

The building owner or occupier shall be responsible for service to and service quality of the FDAS.

11.2 Qualifications

Service to the FDAS shall be undertaken by persons having qualifications and/or experience relevant to the scope of the particular service requirements.

NOTE National regulations might exist for the registration and recognition of individuals with the requisite qualifications and experience. The recognition might form part of a recognized competency framework.

11.3 Service plan

11.3.1 General

The designer shall prepare a service plan of routine inspections, tests, and preventive maintenance to continuously preserve the function and performance of the FDAS and to demonstrate that the FDAS functions and is capable of performing to a standard not less than that to which it was originally designed.

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11.3.2 Precautions

Inspection, testing, and preventive maintenance of the FDAS shall be carried out after notifying building occupants.

11.3.3 Routine inspection

Inspect the FDAS in accordance with Table 2 at intervals not exceeding 6 months and record the results of the inspection.

Table 2 — Inspection schedule

Reference subclause	Action required
6.6	Inspect detectors for any condition that is likely to adversely affect their operation, such as excessive deposition of dust or coating of paint.
6.11.2	Inspect the location of the FDCIE and that the FDAS is in the quiescent condition.
6.11.3	Inspect any door covering the FDCIE.
6.12.4	Inspect battery ventilation and protection against corrosion.
6.9	Inspect manual call points for clearance and ease of access.
6.10	Inspect alarm devices for clearance, visibility, and marking.
6.19	Inspect the documentation to ensure it is available and complete.

If the inspection determines that the item fails to comply with the requirements of this part of ISO 7240, it is important that the building owner takes actions to remedy the non-compliance.

11.3.4 Tests

Test the FDAS in accordance with Table 3 and record the results of the tests.

Table 3 — Test schedule

Item	Action required	Test interval period (months)
1	Test that an alarm simulated from a detection zone causes the FDCIE to enter the alarm condition and all required outputs (e.g. alarm devices, routing equipment, fire suppression systems, smoke control systems) activate, including delayed outputs. Confirm that all required visual and audible indications and outputs activate at the FDCIE.	6
2	Test that a fault condition occurs for the following events: a) the removal of a detector from a detection zone; b) the failure of the transmission path between the FDAS and other systems; c) the failure of the transmission path to networked equipment. Confirm that all required visual and audible indications and outputs activate at the FDCIE.	6
3	Test that disabling a detector in a detection zone causes the FDCIE to enter the disabled condition. Confirm that all required visual and audible indications and outputs activate at the FDCIE.	6
4	Test the operation of 20 % of point-type heat detectors using a heat source so that all heat detectors are tested over 5 years.	12
5	Test the operation of line-type heat detectors using a heat source.	12
6	Test the operation of 50 % of point-type smoke detectors using smoke or suitable aerosols so that all smoke detectors are tested over 2 years.	12
7	Test the operation of all line-type smoke detectors using neutral density light filters of the appropriate obscuration percentages.	12

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Table 3 *(continued)*

Item	Action required	Test interval period (months)
8	Test 50 % of sampling points in aspirating smoke detectors using smoke or suitable aerosols so that all sampling points are tested over 2 years. Ensure the transport time is within 15 % of the required value at commissioning.	12
9	Test the operation of 50 % of flame detectors using flame or simulated flame so that all flame detectors are tested over 2 years.	12
10	Test the operation of 50 % of CO detectors using CO or a suitable gas so that all detectors are tested over 2 years.	12
11	Test the operation of all manual call points.	12
12	Test that the audible alarm devices are audible throughout the building and ensure the sound pressure level meets the requirements of the commissioning report.	12
13	Test that the light output level from visual alarm devices is no less than the design requirements.	12
14	Test that the standby power source capacity is equal to or greater than the calculated requirements.	12

If the tests determine that any item fails to comply with the requirements of this part of ISO 7240, it is important that the building owner takes actions to remedy the non-compliance.

11.3.5 Preventive maintenance

Unless the power supply equipment batteries have been tested and found to have sufficient capacity to fulfil the requirements of this part of ISO 7240, replace the batteries after the manufacturer's recommended battery service life.

11.3.6 Reports

Following each inspection, test, preventive maintenance action, and repair, a report shall be submitted to the building owner or occupier that details the activities undertaken. The subsequent result shall include the following:

— building or site name;

— address;

— building owner;

— date(s) of commissioning;

— person(s) and company performing the commissioning;

— results of the individual actions.

11.4 Documentation

11.4.1 Instructions

11.4.1.1 The information left at the building or structure upon completion of the installation shall be such that a reasonably competent person who has never seen the site before can investigate faults and instigate repairs without any undue delay.

11.4.1.2 Service manuals shall give details of all work required to service the installation, including

a) method of service,

b) any sequence related to service,

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c) identification of parts requiring service, giving reference to the location of items on drawings, together with manufacturers' or suppliers' reference numbers,

d) at least one set of equipment and materials catalogues,

e) list and location of spare parts,

f) list and location of special tools,

g) any test certificates that can be required for examination by the relevant authority, and

h) a set of "as installed" drawings using internationally recognized symbols for equipment.

11.4.1.3 Service manuals shall be provided in a form best suited to the environment in which they are used. They may take the form of bound documents or data files, or both, or some other means.

11.4.2 Records to be kept

11.4.2.1 General

Installation, log, and service records shall be kept by the end user and/or service organization.

11.4.2.2 Installation

Installation records shall comprise the following:

a) details of the locations of all items of equipment including "as installed" schematics showing the cable labelling of the interconnections, these having been certified as true, preferably by an independent reviewer;

b) "as installed" performance measurements of the FDAS on a detection zone-by-detection zone and circuit-by-circuit basis, including

   — measured alarm and fault performance per detection zone,

   — settings of any adjustable items within the FDAS, including signal delay settings for detectors and outputs.

11.4.2.3 Log

11.4.2.3.1 A means of recording and securely preserving the dates and times of routine and/or preventive maintenance and test activities, any remedial action taken, and by whom and on whose authority shall be provided in a format that is appropriate to the building, its FDAS installation, and its operational use.

NOTE The purpose of such a log is to allow

— investigation of an incident if it is suggested that the FDAS failed to operate at the time of an incident, and

— service personnel to monitor the pattern of faults arising, so aiding the diagnosis of FDAS problems and the management of preventive maintenance.

11.4.2.3.2 The log shall include

— dates and times of usage of the FDAS,

— details of tests and routine checks carried out,

— time and date of each fault occurrence,

— details of the fault found and the circumstances of its identification (for example, during routine maintenance),

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— action taken to rectify or remedy,

— date, time, and name of person in charge of the FDAS, and

— countersignature of the responsible person, if any faults have occurred or have been rectified.

12 Abnormal situations

12.1 The emergency management plan shall include steps to be taken in the following events:

— failure of all or part of the FDAS;

— where part of the FDAS is disconnected or disabled;

— actions after a fire;

— actions after a fault;

— actions after an unwanted alarm;

— extensions or alterations to the FDAS.

12.2 Where the FDAS or part of the FDAS is not available for use in an emergency, the building occupier shall be advised.

13 Special systems

13.1 Fire and intrusion systems

Where the FDAS is integrated with an intrusion alarm system, the requirements of this part of ISO 7240 shall apply.

13.2 Fire and building automation systems

Where the FDAS is integrated with a building automation system, the FDAS may send events to the building automation systems. The building automation shall not initiate any control of the FDAS except for a test of the FDAS.

13.3 Connection to computer not being a required part

Where the FDAS is connected to a computer, not being a required part of the FDAS, the FDAS may send events to the computer. The computer shall not initiate any control of the FDAS except for a test of the FDAS.

13.4 National requirements

Other national regulations may modify the requirements specified in this part of ISO 7240, in which case the national regulations shall take precedence.

13.5 Electrical safety

Electrical wiring shall meet national safety requirements. Where national requirements do not exist, the requirements specified in IEC 60364 shall apply.

13.6 Radiation hazards

Certain types of smoke detectors contain radioactive materials. Use of such smoke detectors shall comply with the applicable national standards. Where no national standards exist, the recommendations of

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the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development (OECD) shall apply.

14 Alterations to existing installations

14.1 Alterations to existing installations shall be designed, installed, and commissioned in accordance with the requirements of this part of ISO 7240 to ensure that there are no detrimental effects to the existing installation and equipment.

14.2 The design of the alterations shall include an assessment of the following:

— re-calculation of power supply requirements;

— compatibility of proposed equipment with existing equipment.

14.3 The documentation shall be revised to include the alterations.

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Annex A
(informative)

Power source calculations

A.1 Battery capacity

A.1.1 The battery capacity requirement should be determined as follows.

a) Determine the quiescent load current, I_Q. Where the load can vary, the worst-case average over any 24 h period shall be used.

b) Determine the full load current, I_A.

c) Determine the capacity derating factor, F_C, of the battery when discharged at I_A, taking into account the minimum operating voltage of the FDAS.

NOTE A derating factor of 2 is typical.

d) The 20 h discharge rate battery capacity, C_{20}, at 15 °C to 30 °C shall be determined as given by Formula (A.1):

$$C_{20} = 1{,}25\left[\left(I_Q \times T_Q\right) + F_C\left(I_A \times T_A\right)\right] \quad \text{(A.1)}$$

where

1,25 is a factor for expected battery deterioration;

I_Q is the total quiescent current;

T_Q is the quiescent standby power source time (nominally 24 h);

F_C is the battery derating factor at I_A;

I_A is the total current in the alarm condition;

T_A is the full load standby power source time (nominally 0,5 h).

A.1.2 Where the average battery temperature is outside 15 °C to 30 °C, the battery manufacturer's data shall be used to determine any further derating factor to be applied.

A.2 Charging current

A.2.1 The battery charging current should return a charge to a discharged battery, within 24 h, sufficient to maintain the FDAS for 5 h with normal quiescent load followed by 30 min in the alarm condition.

A.2.2 A discharged battery is one that has reached either the minimum FDAS operating voltage or the minimum voltage specified by the battery manufacturer when discharged at the nominal quiescent current.

A.2.3 The minimum charging current, I_C, is calculated as given by Formula (A.2):

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$$I_C = \frac{1{,}25\left[\left(I_Q \times 5\right) + F_C\left(I_A \times 0{,}5\right)\right]}{24} \quad \text{(A.2)}$$

where

1,25 is the uplift factor to account for various losses during charging;

I_Q is the total quiescent current;

F_C is the battery derating factor at I_A;

I_A is the total current in the alarm condition.

A.3 Power source calculations

The main power source capacity is required to meet the requirements of this part of ISO 7240. A typical calculation for the total current, I_{PSE}, required to power the FDAS in the quiescent condition and to charge the battery is given by Formula (A.3), and that for the total quiescent current, I_Q, is given by Formula (A.4):

$$I_{PSE} = I_Q + I_C \quad \text{(A.3)}$$

$$I_Q = I_{QWS} + I_{QANC} \quad \text{(A.4)}$$

where

I_C is the charging current;

I_Q is the total quiescent current;

I_{QWS} is the highest quiescent current of the FDAS;

I_{QANC} is the quiescent current of any ancillary load.

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