ПІДТВЕРДЖУВАЛЬНЕ ПОВІДОМЛЕННЯ

Державне підприємство
«Український науково-дослідний і навчальний центр
проблем стандартизації, сертифікації та якості»
(ДП «УкрНДНЦ»)

Наказ від 16.06.2021 № 226

CEN/TS 54-14:2018

Fire detection and fire alarm systems - Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance

прийнято як національний стандарт методом «підтвердження» за позначенням

ДСТУ CEN/TS 54-14:2021
(CEN/TS 54-14:2018, IDT)

Системи пожежної сигналізації та оповіщування. Частина 14. Настанови щодо побудови, проектування, монтування, пусконалагоджування, введення в експлуатацію, експлуатування та технічного обслуговування

З наданням чинності від 2021-07-01

Відповідає офіційному тексту

З питань придбання
офіційного видання звертайтесь до
національного органу стандартизації
(ДП «УкрНДНЦ» http://uas.org.ua)

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 54-14

October 2018

ICS 13.220.20

Supersedes CEN/TS 54-14:2004

English Version

Fire detection and fire alarm systems - Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance

Guide d'application pour la planification, la conception, l'installation, la mise en service, l'exploitation et la maintenance des systèmes de détection et d'alarme incendie

Brandmeldeanlagen - Teil 14: Leitfaden für Planung, Projektierung, Montage, Inbetriebsetzung, Betrieb und Instandhaltung

This Technical Specification (CEN/TS) was approved by CEN on 2 March 2018 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. CEN/TS 54-14:2018: E

Contents

Page

European foreword

This document (CEN/TS 54-14:2018) has been prepared by Technical Committee CEN/TC 72 "Fire detection and fire alarm systems", the secretariat of which is held by BSI.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 54-14:2004.

Compared to CEN/TS 54-14:2004, the following main changes have been made:

— all facts and figures of Annex A have been transferred into the main text and modernized;

— Table A.1 was modified to incorporate new technologies;

— new detector technologies e.g. multi sensor detectors or radio-linked detectors were incorporated;

— new requirements for cabling;

— all requirements for certification were eliminated;

— Annex D: Maintenance routine is new;

— Annex E: Commissioning checklist is new.

EN 54, *Fire detection and fire alarm systems*, consists of the following parts:

— *Part 1: Introduction*;

— *Part 2: Control and indicating equipment*;

— *Part 3: Fire alarm devices — Sounders*;

— *Part 4: Power supply equipment*;

— *Part 5: Heat detectors — Point detectors*;

— *Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization*;

— *Part 10: Flame detectors — Point detectors*;

— *Part 11: Manual call points*;

— *Part 12: Smoke detectors — Line detectors using an optical beam*;

— *Part 13: Compatibility assessment of system components*;

— *Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance* [CEN Technical Specification];

— *Part 16: Voice alarm control and indicating equipment*.

— *Part 17: Short circuit isolators*;

— *Part 18: Input/output devices*;

— *Part 20: Aspirating smoke detectors*;

— *Part 21: Alarm transmission and fault warning routing equipment*;

— *Part 22: Resettable line-type heat detectors*;

— *Part 23: Fire alarm devices — Visual alarms devices*;

— *Part 24: Components of voice alarm systems — Loudspeakers*;

— *Part 25: Components using radio links*;

— *Part 26: Carbon monoxide detectors — Point detectors*;

— *Part 27: Duct smoke detectors*;

— *Part 28: Non-resettable line type heat detectors* [currently at voting stage];

— *Part 29: Multi-sensor fire detectors — Point detectors using a combination of smoke and heat sensors*;

— *Part 30: Multi-sensor fire detectors — Point detectors using a combination of carbon monoxide and heat sensors;*

— *Part 31: Multi-sensor fire detectors — Point detectors using a combination of smoke, carbon monoxide and optionally heat sensors*;

— *Part 32: Planning, design, installation, commissioning, use and maintenance of voice alarm systems* [CEN Technical Specification].

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Guidelines and standards for the planning, design, installation, commissioning, use and maintenance of a fire detection and fire alarm system are published by many different organizations within Europe.

This document is intended as a template to be used in the drafting, review and revision of any such national standards and guidelines. It is intended that this technical specification will assist in the harmonization of practice and standards of fire detection and fire alarm systems throughout Europe.

1 Scope

This document provides guidelines for the application of automatic fire detection and fire alarm systems in and around buildings. The guideline covers planning, design, installation, commissioning, use and maintenance of the systems.

The guidelines cover systems intended for the protection of life and/or the protection of property. The guidelines cover systems with a control and indicating equipment and at least one manual call point or one fire detector. In the event of a fire the systems may be capable of providing signals to initiate the operation of ancillary equipment (such as fixed fire extinguishing systems) and other precautions and actions (such as machinery shutdown or remote transmission of alarms). These guidelines do not cover the ancillary services themselves or ancillary circuits to interface with them.

The guidelines do not cover systems combining fire alarm functions with other non-fire related functions.

The guidelines do not recommend whether or not an automatic fire detection and/or fire alarm system should be installed in any given premises.

These guidelines should be used by appropriately competent persons. However, guidance is also given to other persons purchasing or using a fire detection and / or fire alarm system.

Smoke alarms according to EN 14604 are not fire detection and fire alarm systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 54-1:2011, *Fire detection and fire alarm systems — Part 1: Introduction*

EN 54-2:1997, *Fire detection and fire alarm systems — Part 2: Control and indicating equipment*

EN 54-3, *Fire detection and fire alarm systems — Part 3: Fire alarm devices — Sounders*

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

EN 54-5, *Fire detection and fire alarm systems — Part 5: Heat detectors — Point heat detectors*

EN 54-7, *Fire detection and fire alarm systems — Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization*

EN 54-10, *Fire detection and fire alarm systems — Part 10: Flame detectors — Point detectors*

EN 54-11, *Fire detection and fire alarm systems — Part 11: Manual call points*

EN 54-12, *Fire detection and fire alarm systems — Part 12: Smoke detectors — Line detectors using an optical beam*

EN 54-16, *Fire detection and fire alarm systems — Part 16: Voice alarm control and indicating equipment*

EN 54-20, *Fire detection and fire alarm systems — Part 20: Aspirating smoke detectors*

EN 54-21, *Fire detection and fire alarm systems — Part 21: Alarm transmission and fault warning routing equipment*

EN 54-22, *Fire detection and fire alarm systems — Part 22: Resettable line-type heat detectors*

EN 54-23, *Fire detection and fire alarm systems — Part 23: Fire alarm devices — Visual alarm devices*

EN 54-24, *Fire detection and fire alarm systems — Part 24: Components of voice alarm systems - Loudspeakers*

EN 54-25, *Fire detection and fire alarm systems — Part 25: Components using radio links*

EN 54-27, *Fire detection and fire alarms systems — Part 27: Duct smoke detectors*

EN 54-28, *Fire detection and fire alarm system — Part 28: Non-resettable line-type heat detectors*

EN 54-29, *Fire detection and fire alarm systems — Part 29: Multi-sensor fire detectors - Point detectors using a combination of smoke and heat sensors*

CEN/TS 54-32, *Fire detection and fire alarm systems — Part 32: Planning, design, installation, commissioning, use and maintenance of voice alarm systems*

EN 16763:2017, *Services for fire safety systems and security systems*

EN 50200:2015, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

EN 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications (IEC 61672 1)*

BS 8434-2, *Methods of test for assessment of the fire integrity of electric cables. Test for unprotected small cables for use in emergency circuits. BS EN 50200 with a 930° flame and with water spray*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 54-1:2011 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
acceptance
decision that the installed system meets the requirements of a previously agreed specification

3.2
alarm load
maximum power (normally electrical) that might be required under the fire condition

3.3
approval
acceptance by a third party that the installed system satisfies the requirements of the third party

3.4
approval body
body accepted by an authority having jurisdiction or other competent organization as having the expertise necessary to assess the compliance of the installed system with this guidelines

3.5
authority having jurisdiction
body that has powers provided under local, regional, national or European legislation

3.6
beam detector
more commonly used term for 'smoke detector - line detector using a transmitted light beam'

NOTE See EN 54-12.

3.7
circuit
interconnected assembly of cables, components and elements, terminated at the control and indicating equipment in such a way that its only connection to other parts of the fire detection and alarm system is through the control and indicating equipment and controlled by the control and indicating equipment

Note 1 to entry: A circuit may have more than one link to the control and indicating equipment (as in a loop circuit, connected to the control and indicating equipment at both ends).

Note 2 to entry: If two or more cables are directly linked together inside the control and indicating equipment, without the possibility of control by the link, then they are part of the same circuit.

Note 3 to entry: The transmission path for radio linked system is part of a circuit.

3.8
commissioning
process by which it is verified that the installed system meets the defined requirements

3.9
commissioning engineer
person who carries out the process of commissioning

3.10
competent person
person with the relevant current training and experience, and with access to the requisite tools, equipment and information, and capable of carrying out a defined task

3.11
configuration
programming the CIE to perform the functions intended by the designer, the relevant guidelines and the fire protection strategy

3.12
designer
person or organization taking responsibility for the work outlined in Clause 6

3.13
detection zone card
portable detection zone map, covering one or more individual zones

3.14
detection zone map
diagram showing the geographic boundaries of zones and, if necessary access routes to zones

NOTE A detection zone map is usually fixed in the vicinity of the CIE or at the entrance to the zone.

3.15
false alarm
fire alarm caused by reasons other than fire

NOTE There are different words in EU countries used to describe false alarms.

3.16
fault
failure within the system in such a way as to jeopardize the correct functioning of the system

3.17
fault warning
fault signal perceptible to a person

3.18
fault warning receiving station
routing equipment installed in fault warning receiving centre, receiving fault warnings

3.19
fire alarm
visual, audible or tactile indication of fire

3.20
fire alarm response strategy
pre-planned procedures which are expected to be followed when a fire alarm occurs

3.21
fire compartment
compartment whose boundary components are required by regulations to have a defined fire resistance

NOTE Sub-fire compartments can exist within a principle fire compartment.

3.22
fire signal
signal intended to indicate the occurrence of a fire

3.23
fire alarm receiving station
routing equipment installed in fire alarm receiving centre, receiving and confirming fire alarms

NOTE Alarm receiving centre (ARC) = Fire alarm receiving centre.

3.24
initialization
first power up of the fire alarm system – prior to configuration and commissioning but post installation

3.25
inspection
routine processes by which the system, its functioning and its indications are manually checked at pre-determined intervals

3.26
installer
person or organization having responsibility for all or part of the process of installation

3.27
integrated system
system in which the fire detection and alarm functions are integrated with other functions that do not deal with fire-fighting, fire protection or evacuation in case of fire

3.28
licensing body
central, local or municipal government organization responsible for licensing the use or occupation of a building

3.29
maintenance
work of inspection, servicing and repair necessary in order to maintain the efficient operation of the installed system

3.30
mimic diagram
diagrammatic representation of the building, carrying active indications which are directly related to the building layout

3.31
national document
document, published by a national standards body which is not a European harmonized standard

3.32
pre-alarm warning
warning given when the signal from a sensor exceeds the normal level but has not yet reached the fire level

3.33
qualified
person or organization which fulfills the requirements of EN 16763:2017

3.34
repair
non-routine work necessary to restore the efficient operation of the installed system

3.35
repeat indicating panel
panel which replicates all or some of the indications of the control and indicating equipment

3.36
search distance
distance which needs to be travelled by a searcher within a detection zone in order to determine visually the position of a fire

NOTE The distance is not measured between the point of entry of the detection zone and the location of the fire, but only between the point of entry and the location at which a person searching for the fire would first become aware of the location of the fire.

3.37
servicing
routine processes of work on the system (including cleaning, re-alignment, adjustment and replacement) carried out at pre-determined intervals

3.38
third party
body or organization other than the installer, supplier or customer

3.39
user
person or organization managing of the building (or part of the building) in which the fire detection and alarm system is installed

3.40
verification
process by which the installer or other party satisfies the customer that the installed system meets the defined requirements

3.41
zone
geographical sub-division of the protected premises in which a function may be carried out separately from any other sub-division

Note 1 to entry: The function may, for instance, be:

— the indication of the occurrence of a fire (detection zone);

— the giving of a fire alarm (alarm zone).

Note 2 to entry: Zoning for different functions need not be identical.

4 General

4.1 Guideline usage

These guidelines provide recommendations for planning, design, installation, commissioning, use and maintenance of fire detection and fire alarm systems.

These recommendations are not mandatory, but provide a suitable basis for the provision and usage of good systems. As such they specify what "should" be done, rather than giving requirements on what "shall" be done.

NOTE An authority having power under local or national legislation such as the fire brigade or building control or insurer, can require compliance with the recommendations.

The competence of the persons or organizations carrying out any kind of work referred to in these guidelines should be appropriately qualified.

4.2 Guideline format

It is appreciated that the guidelines cannot cover every possible case that might arise. For this reason, departure from the recommendations are possible, provided that they have been discussed and agreed between all interested parties (see 5.2).

These guidelines have been drawn up as if the provision and use of an installed system will follow the pattern shown in Figure 1.

It is assumed that the first step in the design process is to assess the needs of the building for fire detection and fire alarm (see Clause 5). This may include an assessment of:

a) whether part or all of the building is to be protected;

b) the type of system to be installed; (e.g. manual or automatic, property or life protection, alarm notification, etc.);

c) the interaction of the system with other fire protection measures.

The second step is planning and design of the system (see Clause 6). This may include:

d) the selection of detector type and siting for the various parts of the building;

e) subdivision of the building into detection and/or alarm zones;

f) provision for control of the system and for the display of its indications;

g) the provision of power supplies;

h) provision for audio and visual alarm device and guidance systems;

i) provision for controlling automatic fire protection (where relevant);

j) provision for alarm and fault warning transmission.

The third step is the process of mounting and interconnecting the equipment (see Clause 7).

The fourth step is the initialization (power up) and configuration of the system.

The fifth step is the commissioning of the system and verification of correct operation (see Clause 9). Once the system has been handed over to the purchaser, satisfactory performance will depend on proper usage, maintenance and servicing (see Clauses 11, 12).

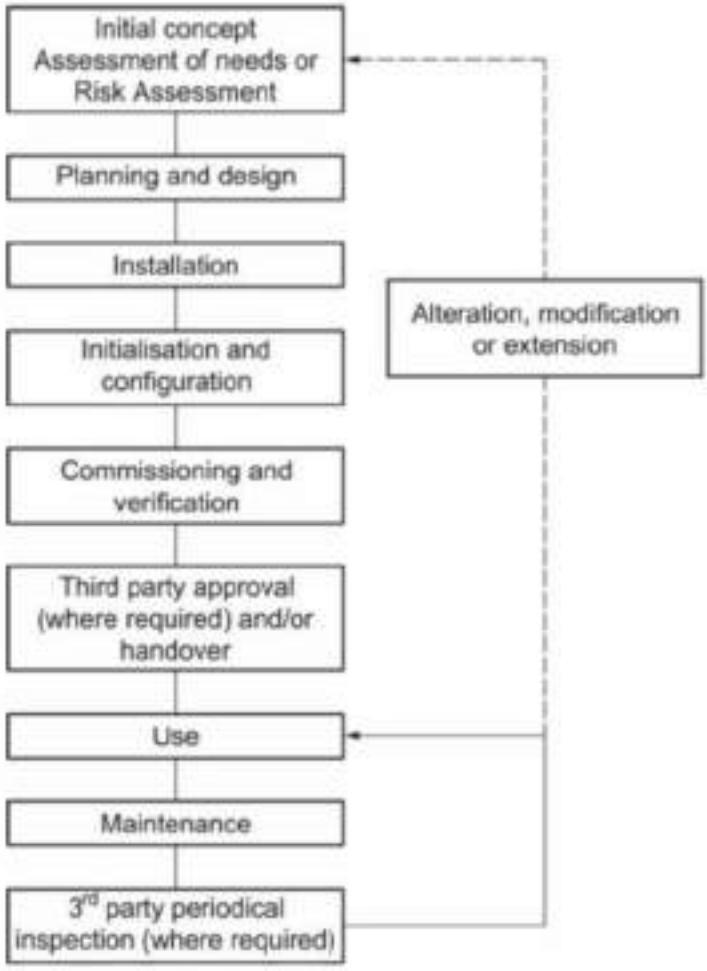


Figure 1 — Idealized system flow chart

The guidelines are written as if each of the processes covered in Figure 1 is carried out by a different organization. That organization will have its own expertise, but will also need information derived from previous work. So at each stage the guidelines give recommendations on qualifications of personnel or organizations, responsibility for the work, and documentation to be carried on from one stage to the next.

4.3 False alarms

False alarms can be expensive in disruption of the building operations and availability of the fire services, and may lead to a real alarm being ignored. It is essential that the utmost care should be taken by system designers, installers and users and/or owners to avoid false alarms. Guidance on the causes and prevention of false alarms is given in Annex A.

4.4 Documentation

Proper performance of each stage of the work should be documented and handed over by the person or organization taking responsibility for that stage.

4.5 Responsibility

Responsibility for the planning, design, installation and the initial performance of the installed system should be clearly defined and documented.

It is frequently desirable that, at the contract stage, one organization should take overall responsibility for the project.

4.6 Qualifications

Persons or organizations carrying out any work referred to in these guidelines should be appropriately competent, experienced and qualified: see also EN 16763:2017.

5 Assessment of needs

5.1 Purpose

Fire detection and fire alarm systems may be installed for the protection of life, of property, of the environment or any combination thereof.

5.2 Consultation

Where the installed system is subject to legislation, the authority having jurisdiction should be consulted and their requirements established. The requirements for the system to be installed should be decided by the purchaser of the system after consultation with other interested parties.

NOTE 1 Other interested parties may include organizations such as:

— system supplier(s);

— installer of the system;

— designers and installers of other fire protection systems in the protected premises;

— fire risk insurer;

— fire rescue services/fire authority.

These requirements should include any need for third party approval. Since the design of the system may depend on the requirements of the licensing body, it is important that this body is identified at the earliest stage possible, and its requirements established.

If approval is required from more than one licensing body, and these bodies have different requirements for the installed system, then the installed system should be designed to meet the most stringent of the requirements. In the unlikely event that the requirements of two licensing bodies are incompatible, then the incompatibility should be resolved by discussion.

NOTE 2 Points which may need to be covered include:

a) use of new developments in fire detection;

b) fire alarm response strategy;

c) differing requirements of approval bodies;

d) use of hierarchical systems;

e) any departures from the recommendations of these guidelines;

f) limitations on the effects of faults;

g) sizes of detection zones;

h) conditions of use of the products which are not covered by any other part of the EN 54 series;

i) siting of control and indicating equipment;

j) provision of alarm location aids;

k) standby duration required from batteries;

l) use of activity related systems to reduce false alarms;

m) fire alarm notification;

n) fault warning and remote servicing.

5.3 Parts of the building needing cover

5.3.1 Extent of cover

The parts of the building to be covered or the types of system to be installed may be specified by a third party, such as by an authority having jurisdiction or by an insurance company.

Where the extent of the system is not specified by a third party, or where there is a need to install a more extensive system, the following items should be considered in assessing the risk in each area:

a) probability of ignition;

b) probability of spread inside the room of origin;

c) probability of spread beyond the room of origin;

d) consequences of a fire (including probability of death, injury, loss of property and environmental damage);

e) existence of other methods of fire protection.

5.3.2 Description of extent

The extent of cover may be described as one, or a combination of:

a) total cover: cover of all parts of the building;

b) fire compartment cover: cover of one or more specified fire compartments within the building;

c) escape route cover: cover restricted to that which is necessary to ensure that escape routes can be used before they are blocked by fire or smoke;

d) local cover: cover of a specific area, (other than escape routes) within the building, not necessarily forming the whole of a fire compartment;

e) equipment cover: cover of a specific apparatus or equipment;

f) manual fire detection system: a fire detection system which is triggered only by manual call points.

5.3.3 Total cover

A total cover system is an automatic fire detection system covering all spaces in the building other than those specifically exempted in 5.3.9.

5.3.4 Fire compartment cover

A fire compartment cover system is an automatic fire detection system covering only some parts of the building. The boundaries of a fire compartment cover system are the fire compartment boundaries; within those boundaries the cover should be the same as that of a total cover system.

If a partial cover system is to be used, then the parts of the building to be protected should be specified in the documentation of 5.6.

5.3.5 Escape route cover

A system protecting only the means of escape is intended to give warning of a fire in time for people to escape before they become trapped by smoke or heat. Such a system should not be expected to protect people who might be in the room of origin of the fire; it is intended only to allow safe escape for those not immediately involved.

5.3.6 Local cover

Local cover may be provided to protect particular areas.

Local cover on its own can provide detection of fires starting within the protected area, but can give no detection against fires starting outside that area.

Enhanced local cover.

The area of local cover may not be isolated; it can be within an area of total or compartment cover, in any case given a higher level of protection than that given by the more general cover.

For example combination of targeted or enhanced sensitivity sensing technologies for the protection of specific risks.

5.3.7 Equipment cover

Equipment cover is provided to give detection of fires starting inside particular pieces of equipment. The detectors providing equipment cover are usually mounted within or adjacent to the equipment enclosure, and can hence detect a fire at an earlier stage than can detectors for more general cover.

As with local cover, equipment cover on its own can provide detection of fires starting within the equipment, but can give little or no detection of fires starting outside that equipment.

5.3.8 Manual detection system

A system in which a fire alarm (indication and transmission) can only be initiated manually by persons who have detected the fire.

NOTE The system may have one single automatic detector in the vicinity of the CIE.

5.3.9 Areas not needing cover

Unless there are special requirements, some areas may be considered to have a sufficiently low risk of fire that they need not be covered.

Areas not needing cover by automatic detection may include:

a) unventilated frozen food stores with gross volumes below 20 m^3;

b) bathrooms, shower rooms, washrooms or water closets, provided that they are not used for the storage of combustible materials or rubbish;

c) vertical shafts or vertical cable ducts with cross-sectional areas of less than 2 m^2, provided that they are properly fire protected and fire-stopped where they pass through floors and ceilings or walls, and the cables installed are of reaction-to-fire performance class B2ca according to EN 50399. If the shafts or ducts contain cables concerned with emergency systems these cables shall resist fire for at least 30 min; if the shafts or ducts contain cables of the fire detection and alarm system the shaft or duct shall be monitored by automatic detectors;

d) unroofed loading bays;

e) roofed loading bays if these are protected by a sprinkler system;

f) voids (including under-floor and above-ceiling voids) need only have cover by detectors if:

   1) there is likely to be extensive spread of fire or smoke outside the room of origin through the void before the fire is detected by detectors outside the void; or

   2) a fire in the void is likely to damage cables of emergency systems before the fire is detected;

g) Voids which:

   1) do not contain fire load densities in excess of 25 MJ of combustible material in any 1 m^2 (see Annex C); and

   2) do not contain fire load densities in excess of 15 MJ of combustible material in any 1 m^2 (see Annex C) if the voids contain cables concerned with emergency systems

need not have independent detector cover.

5.4 Fire brigade attendance

5.4.1 Communications

Methods of communication with the fire brigade may be automatic or manual (e.g. by telephone), depending on national legislation. Automatic methods of communication may be directly to the fire brigade or indirectly through a manned station), depending on national legislation. The alarm transmission equipment shall comply with EN 54-21.

5.4.2 Delay to output E according to EN 54-2

If a delay to output E is allowed depends on national regulations and shall comply to EN 54-2:1997, 7.11 which defines the following types:

— with manual and timed override;

— with automatic override.

5.5 Fire alarm response strategy

The design of the fire detection and fire alarm system may depend on the actions required after the fire has been detected. It is thus essential that these actions are pre-planned and the subject of early discussion (see 5.2).

As a minimum, the following information should be available to and taken into account by the person responsible for planning of the fire alarm response strategy, and should be included in the documentation of 5.6:

a) What pattern of evacuation is expected in case of fire, and will this pattern depend on the position of the fire?

b) What is the expected occupancy of the building, and how will this vary with time or day?

c) How are occupants to be informed or pre-warned of the fire condition?

d) What are the requirements for indicating the fire location?

e) Arising from a) and d), how the building shall be divided into detection and alarm zones?

f) In large or interconnected buildings (such as shopping malls) will a hierarchical system be needed, will multiple control stations be provided, and if so, what arrangements will be needed for transfer of control between control stations?

g) How will the fire brigade be called and what information shall be given?

h) Will any special facilities be needed for the fire brigade?

i) Are special provisions likely to be needed for reducing the effects of false alarms?

j) Will there be any change in the fire alarm response strategy between night and day, or between working days and holidays?

k) Will there be any interaction with other active fire protection measures, such as special requirements for the operation and zoning of ancillary equipment?

l) Will the building have special provisions for emergency power supplies?

m) Will the system (or parts of the system) be required to remain operational for a significant time after the initial detection of fire? (For example, will alarm devices be required to sound for a certain time after detection?)

5.6 Documentation

Documents should be prepared covering the general requirements for the installed fire detection and alarm system, including the fire alarm response strategy (see 5.2 - 5.5) in so far as it can be defined before final occupancy of the building. The amount of information given in these documents should be sufficient to allow detailed designs to be prepared.

The documents should also include where applicable:

a) any requirements for third party approval or acceptance;

b) information on any areas of the building which contain special risks, see Clause 15;

c) any requirement for specific functions in EN 54-2 where they are mandatory under national regulations.

5.7 Responsibility

Responsibility for the assessment, and for the completeness and accuracy of the documentation of 5.6 should be defined by the purchaser of the system.

5.8 Qualifications

The person or organization carrying out the assessment and preparing the documentation of 5.6 should have adequate theoretical and practical knowledge to be able to carry out the necessary work: see also EN 16763:2017.

6 Planning and design

6.1 Devices connected to the system

6.1.1 Components

Devices used in the system should comply with the requirements of the relevant parts of the EN 54 series.

For devices where there is no relevant part of the EN 54 series should be demonstrated to have no detrimental effect on the performance on the system, e.g. through compliance with other National, European, or international standards or other accepted documents.

6.2 System design

6.2.1 Compatibility

The compatibility of system components should meet the requirements of and be assessed to EN 54-13.

6.2.2 Fault effects

6.2.2.1 Fault effect limitation

The design of the system should be such that the effects of faults in transmission paths, cables or connections are restricted.

The approaches below have the same aim to limit the consequences of faults and either approach provides suitable protection for the integrity of the system.

Two alternative approaches to fault effect limitation are possible as presented in 6.2.2.2 and 6.2.2.3; one is based on the use of fire resistant cables and multiple functions may be used on a single cable, alternatively if non fire resistant cable is used then separate functions should be implemented on separate cables.

6.2.2.2 Non-fire resistant cables

A single fault in a transmission path should not prevent the correct operation of more than one of the following functions in one zone:

— manual initiating function;

— automatic fire detection function;

— fire alarm function.

At least one alarm device shall be left in operation.

6.2.2.3 Fire resistant cables

A single fault in any individual transmission path cannot prevent:

a) the initiation of a fire signal in an area greater than that allowed for a single detection zone; or

b) the sounding of a fire alarm in an area greater than that allowed for a single alarm zone; or

c) the operation of all alarm devices within the building (i.e. at least one alarm device shall be left in operation).

The circuit design should be such that in the event of a single short circuit or open circuit cable fault should ensure that not more than 32 automatic detectors or 10 manual call points in a detection zone are rendered inoperative.

The system should be such that two faults in any individual transmission path cannot prevent the operation of either detectors, manual call points or alarm devices over a floor area exceeding 10 000 m^2, or from more than 5 principle fire compartments, whichever is the smaller.

NOTE 1 Small fire compartments within the principle compartment (e.g. electrical switching rooms, computer rooms, disabled refuge, hazardous material storage or voluntary additional internal compartments) are not considered to be a principle fire compartment in terms of the limit of 5.

Where the fire detection system is to be used to initiate the operation of ancillary equipment, there may be additional limitations on the effects of cable faults. These limitations may have significant effects on the design of the fire detection system. These limitations should be specified in the requirements for the

installation of ancillary equipment. Any such requirements should be considered in the consultations of 5.2, and should be followed in the design of the fire detection and alarm system.

Two faults on a single circuit should be considered as including the case of two or more faults caused by a single action.

NOTE 2 To the National Committees: In some high-risk buildings it is possible that the areas specified above are too large. Further restrictions might be defined in national requirements.

6.2.3 Hazardous atmospheres

Legislation can apply where it is necessary to install fire alarm equipment in areas having a potential danger from explosion of combustible gas, dust or vapour.

NOTE Attention is drawn to the requirements of the ATEX Directive for locations with a potentially explosive atmosphere.

6.2.4 False alarms

All possible precautions should be taken to prevent false alarms. Guidance on the causes and prevention of false alarms is given in Annex A.

6.2.5 Connection to fire protection systems

Recommendations for connection to fire protection systems are given in Clause 14.

6.2.6 Special risks

Recommendations for systems covering special risks are given in Clause 15.

6.3 Zones

6.3.1 General

The division of the building into detection and alarm zones should satisfy the requirements of the fire alarm response strategy (see the documentation prepared under 5.6).

6.3.2 Detection zones

The building should be divided into detection zones so that the place of origin of the alarm can be quickly determined from the indications given by the indicating equipment. Provision should be made for identifying manual call point signals.

Where it is not mandatory to connect the fire detection and fire alarm system (fdas) to an alarm receiving centre (ARC) or the fire brigade then the requirement to separately identify the activation by a manual call point will not apply, unless required by the authority having jurisdiction.

The zoning should take into account the internal layout of the building, any possible difficulties of search or movement, the provision of alarm zones and the presence of any special hazards.

Particular care should be taken in zoning where the fire detection system is used to initiate other fire protection systems.

In premises protected by automatic fire detection systems, the division of the premises into detection zones should comply with all the following:

a) a single detection zone may not cover more than one principal fire compartment as defined in national building regulations;

   Small fire compartments within a principle fire compartment may be ignored.

b) a single zone should not exceed an area of 2000 m^2 or contain more than 32 point detectors or result in a search distance of more than 60 m from the point of entry to the zone;

c) where the zone includes more than 5 rooms, then either an indication of the room should be given at the control and indicating equipment or remote indicator lamps should be installed outside each door to indicate the room in which a detector has operated;

NOTE There may be local requirements for special applications such as hospitals.

d) each zone should be restricted to a single storey of the building, unless:

1) the zone consists of a stairwell, lightwell, liftwell or other similar structure extending beyond one storey but within one fire compartment; or

2) the total habitable floor area of the building is less than 300 m^2.

The recommendations of a) to d) above may be varied during the consultation of 5.2, and should then be included in the documentation of 5.6. Factors to be taken into account during the consultation should include:

— visibility within the zone;

— access distances within the zone;

— room configurations and occupation within the zone.

6.3.3 Alarm zones

Division of the building into alarm zones will depend on the need for differentiation in the type of alarm to be given. If an alarm signal is always to be given throughout the building, then no division is necessary. Any division into alarm zones should be in accordance with the fire alarm response strategy.

Alarm zones may contain more than one detection zone, but not vice-versa and the boundaries should coincide.

6.4 Selection of detectors and manual call points

6.4.1 Detectors - General

Factors affecting the choice of detector type may include the following:

a) legislative requirements;

b) materials in the area and the way in which they would burn;

c) configuration of the area (particularly ceiling height);

d) effects of ventilation and heating;

e) ambient conditions and special risks within the surveyed areas;

f) possibility of false alarms;

g) hazardous environments.

The detectors selected should generally be those that will provide the earliest reliable first alarm signal under the environmental conditions of the areas in which they are to be sited. No one type of detector is the most suitable for all applications and the final choice will depend on individual circumstances. It will sometimes be useful to employ two or more different types of detector technology.

Fire detectors are usually designed to detect one or more characteristics of a fire: smoke, heat, radiation (flame) and other products of combustion. Each type of detector responds at a different rate

to different kinds of fire. In general a heat detector gives the slowest response, but a fire that evolves heat rapidly and with very little smoke might operate a heat detector before a smoke detector. In a slowly smouldering fire, such as the initial stages of a fire involving cardboard, a smoke detector would generally operate first. With a combustible liquid fire the earliest detection would generally be given by a flame detector.

The products sensed by heat and smoke detectors are generally transported from the fire to the detector by convection. These detectors rely on the presence of a ceiling (or other similar surface) to direct the products outward from the plume to the detector. They are therefore suitable for use in most buildings, but are generally unsuitable for outside use.

The radiation sensed by flame detectors travels in straight lines and requires no ceiling to direct the combustion products. Flame detectors can therefore be used outside or in rooms with very high ceilings where heat and smoke detectors are unsuitable.

Certain gases like CO, CO_2, NOx accompany each fire. Gas detectors are able to detect those gases and interpret their existence as a fire.

Multisensor detectors are achieved by combining two or more sensors detecting different fire phenomena within one device (e.g. smoke and heat or smoke, heat and CO) and processing the signals of each type using mathematical calculations.

6.4.2 Smoke detectors

Both ionization chamber and optical point type smoke detectors have a sufficiently wide range of response to be of general use. There are, however, specific risks for which each type is particularly suitable (or particularly unsuitable). Although both types shall be approved to EN 54-7 care is needed in the design as to which type is most suitable depending on the characteristics of the particular detector. These characteristics depend on the design and algorithms in use.

NOTE Ionization detectors are prohibited in some European countries.

Aspirating smoke detectors use a pipe system to sample the atmosphere of the protected area, and to carry the sample to a sensor which may be remote from the protected area. A sampling pipe will usually have several sampling orifices. Aspirating smoke detectors are dealt with in EN 54-20 which defines three sensitivity Classes; on Class C, normal sensitivity systems, are used where point detectors cannot be used effectively, i.e. shafts, high-rack warehouses. Class B, enhanced sensitivity systems are used where increased sensitivity is needed to overcome some dilution effects such as high ceilings or moving air flows. Class A – high sensitivity systems are used for areas with high smoke dilution or where the earliest warning is required for the protection of business critical or high value processes or objects.

Beam detectors generally sense obscuration of a "light" beam, and are therefore sensitive to the smoke density over the length of the beam. They are particularly suitable for use where the smoke may have dispersed over a large area before detection, for example below high ceilings (see Table 1). Beam detectors shall comply with EN 54-12.

In general smoke detectors give appreciably faster responses to most fires than do heat detectors, but may be more liable to give false alarms if used in an inappropriate application. If the fire is likely to be restricted to materials that do not produce smoke when burning, then heat or flame detectors should be used in the area.

Where there are production or other processes producing smoke, fumes, dust, etc. which might activate smoke detectors, an alternative type of detector should be considered, e.g. heat or flame.

6.4.3 Heat detectors

Heat detectors are generally considered to be the least sensitive of the available forms of detector. Heat detectors with rate-of-rise algorithms are more suitable where ambient temperatures are low or vary only slowly, while fixed temperature detectors are more suitable where the ambient temperature is

likely to fluctuate rapidly over short periods. Heat detectors can have a greater resistance to adverse environmental conditions than other types of fire detectors.

Point type heat detectors are dealt with in EN 54-5. There are several classes depending on particular characteristics e.g. rate of rise, fixed threshold and for special applications. Line type heat detectors are dealt with in EN 54-22 (resettable) or EN 54-28 (non-resettable).

6.4.4 Flame detectors

Flame detectors detect radiation from fires. Ultraviolet radiation, infrared radiation, or a combination of the two may be used. The radiation spectrum from most flaming materials is sufficiently wide-band to be detected by any flame detector, but with some materials it may be necessary to choose flame detectors capable of responding to specific parts of the wavelength spectrum.

Flame detectors can respond to a flaming fire more quickly than can heat or smoke detectors. However, flame detectors should not be considered as general purpose detectors, because of their inability to detect smouldering fires, so they should only be used where flaming fires are the principal risk.

Flame detector work on line-of-sight so it is not necessary to mount flame detectors on a ceiling but they should only be used if there is a clear line-of-sight to the area being monitored.

Precautions should be taken against contamination on the detector or media that attenuate the radiation, for example;

— oil, grease, dust, glass for Ultraviolet detectors;

— ice, condensation or glass for Infrared detectors.

Care should be taken in the use of flame detectors where production or other processes may lead to false alarms. For example; flash lights, radioactive sources, welding, etc.

If flame detectors are likely to be exposed to sunlight, then "solar-blind" detectors should be chosen.

Flame detectors shall be as dealt with in EN 54-10 which has separate classes for ultraviolet and infrared types.

6.4.5 Combustion gas fire detectors

Combustion gas detectors are point-type detectors that respond to one (or more) of the gases produced by a fire. For example, carbon monoxide is produced when incomplete combustion occurs as a result of restriction of the amount of oxygen available to support the combustion process.

Carbon monoxide can spread by diffusion through certain forms of construction. In the event of fire, therefore, carbon monoxide detectors could operate at a considerable distance from the fire, and on floors other than the floor of fire origin. Care needs to be taken to ensure that this does not result in misleading information for firefighters or others responding to a fire signal.

Electrochemical sensors within combustion gas detectors have a finite life, after which replacement is necessary. It is important that the user is made aware of the likely lifetime of any combustion gas detector used within a fire detection and fire alarm system.

NOTE This section is still open to comment/alteration depending on development of the gas detection standards by CEN/TC 72.

6.4.6 Multi-sensor fire detectors

6.4.6.1 General

Multi-sensor fire detectors are equipped with two or more sensors for fire phenomena whose signals are combined in an appropriate way to make a single fire alarm signal. The decision algorithms may be processed in the detector or in the CIE.

Multi-criteria detectors with several independent sensors within the same housing which lead to separate alarm signals from each sensor are not considered to be multi-sensor fire detectors and should be considered as two or more detectors in one housing (see 6.4.6.5).

Multi-sensor detectors shall comply with single phenomena standards (e.g. EN 54-5 and/or EN 54-7) until such time as specific multi-sensor standards are published.

NOTE A potential advantage of multi-sensor fire detectors is that the strengths and the weaknesses of the different sensors can be balanced due to the combination of the different measured quantities. The result is a potential improvement of the response speed (early detection of fires) and a considerably higher immunity to deceptive phenomena (fewer false alarms).

In general, multi-sensor fire detectors can be used in applications where the use of single sensor detector is likely to result in too many false alarms.

As such it is usual to space such detectors using the recommendations for the type of detector which they are intended to replace (see appropriate part of these guidelines).

6.4.6.2 Multi-sensor fire detectors smoke and heat

Multi-sensor fire detectors combining smoke and heat sensors complying with EN 54-29 are general purpose fire detectors. Multi-sensor fire detectors can be used to achieve:

— a high stability against deceptive phenomena;

— a response to a broad range of fires.

Multi-sensor fire detectors combining smoke and heat are dealt with in EN 54-29.

6.4.6.3 Multi-sensor fire detectors combining carbon monoxide and heat

Some fires may not produce a sufficient amount of CO to trigger an alarm condition from a detector complying with EN 54-26. These are typically free-burning, open, well ventilated fires. The inclusion of heat sensing combined with CO sensing can increase the sensitivity of such a detector to these types of fires.

6.4.6.4 Multi-sensor fire detectors combining smoke, CO and optionally heat

Such detectors are dealt with in EN 54-31.

6.4.6.5 Multi-sensor fire detectors with single sensor operating modes

If a multi-sensor fire detector can be configured to operate such that the sensors act independently to produce independent fire alarm signals then the following shall apply:

— The single sensor operating modes for the detector shall comply with the relevant product standard (e.g. EN 54-7, EN 54-5, etc.).

— The spacing of the detectors shall follow the recommendations for that anticipated fire.

— It shall be possible at or near the CIE (e.g. on the zone maps) to identify that the detector responds to more than one fire phenomenon.

— If the CIE is configured to provide delayed output to the Fire and Rescue Service (see EN 54-2:1997, 7.11) then the alarm activation due to a heat sensor may not be delayed.

If a multi-sensor fire detector can be configured to operate such that one or more of the sensors can be disabled then the following shall apply:

— The single sensor operating modes for the detector shall comply with the relevant product standard (e.g. EN 54-7, EN 54-5, etc.).

— The spacing of the detectors shall follow the recommendations for the single point type detector with the smallest area of coverage.

— It shall be possible at or near the CIE (e.g. on the zone maps) to identify that the detector responds to more than one fire phenomenon.

— If the CIE is configured to provide delayed output to the Fire and Rescue Service (see EN 54-2:1997, 7.11) then the alarm activation due to a heat sensor may not be delayed.

— If it is possible to disable a sensor on access level 2 then the disablement of any sensor should be clearly recorded in the log book and/or may be shown on the CIE.

— If it is not possible to disable a sensor on access level 2 but the disablement times are configured on access level 3 or 4 then the disablement times shall be recorded in the documentation of the fire detection and alarm system.

6.4.7 Radio linked systems

6.4.7.1 Radio linked components

Radio linked components are dealt with in EN 54-25.

EN 54-25 specifies the additional requirements for radio-linked components; the device itself shall also comply with the relevant product standard, e.g. EN 54-7 for point type smoke detectors.

6.4.7.2 Restrictions of use

Some of the recommendations of this standard, applicable to wired systems, are unsuitable for, or cannot be applied to, radio-linked systems. Additional recommendations apply to radio-linked systems in order to address the integrity and performance of the radio communications link between components and the control and indicating equipment. Therefore the use of radio systems may be restricted by local regulations.

6.4.7.3 Radio data records

At the time of commissioning and after the installation of all equipment including remote antenna(e),the following records relating to the radio data shall be recorded:

a) system address;

b) details of the signal level being received at each of the receiver units. This data shall include the received signal levels of all the radio devices and the background noise level. In the case of a networked system (i.e. multiple panel system), this shall also include the signal levels for the radio-links between panels. In addition to other servicing recommendations in other parts of these guidelines, this shall be undertaken at defined intervals.

The record of signal strength and background radio noise may be combined into a single record of signal-to-noise-ratio.

NOTE See also commissioning.

6.4.8 Manual call points

Manual call points are dealt with in EN 54-11.

According to EN 54-11 there are two types of manual call points: Type A (single action) and Type B (double action).

Where practicable a single type should be used throughout the premises.

6.5 Siting and spacing of detectors and manual call points

6.5.1 General

Automatic fire detectors shall be sited so that the combustion products from a fire within the monitored area can reach the detectors without undue dilution, attenuation or delay.

Care shall be taken to ensure that detectors are also sited in hidden areas where fire might start or spread. Such areas may include voids under the floor or above false ceilings.

Manual call points shall be sited so that they can be easily and quickly operated by any person discovering a fire.

Attention shall be given to any special instructions in the manufacturer's data.

Provision shall be made for access for maintenance purposes.

a) Under flat horizontal ceilings.

In general the performance of heat or smoke detectors depends on the presence of a ceiling close above the detectors. Therefore detectors should be sited such that their sensitive elements are more than 25 mm below the ceiling and within the top 10 % of the room height. In addition, detectors should not be mounted more than 600 mm below the ceiling for smoke detectors or more than 150 mm below the ceiling for heat detectors.

Table 1 — Siting and spacing of detectors and manual call points

Room height	Point-type smoke detectors EN 54-7	Linear smoke detectors EN 54-12	Smoke aspiration detectors, Classes A, B and C	Point-type heat detectors EN 54-5 Clases A1, A2, B, C, D, E, F and G [a] [b]	Linear heat detectors EN 54-22 Classes A and A2	Point-type flame detectors EN 54-10 Classes 1, 2 and 3
Up to 45 m		[e] [f]	At least 15 class B holes [f]			[c]
Up to 25 m		[d] [f]	At least 15 class C holes [f]			[c]
Up to 16 m			At least 5 class C holes [f]			[c]
Up to 12 m						
Up to 9 m					Only Class A1	
Up to 7,5 m				Only Class A1		
Up to 6 m						

	Not adequate
	Adequate depending on the usage and environmental conditions (e.g. quick fire development and smoke spreading
	Adequate

[a] Also detectors with class R or S.

[b] Classes B, C, D, E, F and G are adequate only for object protection.

[c] Depending on the class and siting of the detector.

[d] Accepted with certification of the detection efficiency.

[e] Recommended sensitivity of 35 % attenuation or less and full span coverage up to the maximum separation for the beam model selected.

[f] In cases where there are concerns over stratification, a physical fire test is recommended.

The heights for point type smoke detectors are only valid for optical detectors whose sensitivity can be adjusted to the necessary sensitivity using sets of parameters.

Because of the possible existence of a warm boundary layer, the sensing area of a detector should not be recessed into the ceiling.

Optical beam smoke detectors should be mounted on a stable structure.

For new technology or special heat or smoke detectors which are outside the scope of existing standards (other than the compatibility requirements of EN 54-13), the manufacturer's instructions on spacing should be followed. Such detectors should only be used if agreement has been obtained during the consultations of 5.2.

If adverse temperature gradients exist in the protected area then the rising plume from the fire may flatten and form a layer before reaching the ceiling. In addition to the detectors installed close to the ceiling, further detectors may be mounted to take stratification into account.

b) Flat Sloping ceilings.

If the protected space has a pitched roof then detectors should be installed within each apex.

If the difference in height between the bottom of the pitched roof and the top of the apex is less than 600 mm then the roof may be treated as if it were flat if smoke detectors are used.

If the protected space has a north-light (sawtooth) roof then detectors should be installed within sawtooth on the sloping part of the sawtooth at a vertical distance of 1,0 m from the highest point of the sawtooth.

c) Walls, partitions and obstructions.

Detectors (other than optical beam smoke detectors) should not be mounted within 500 mm of any walls or partitions. If the room is narrower than 1 m then the detector should be mounted at or as close as practicable to the centre of the width. Where rooms are divided into sections by walls, partitions or storage racks reaching to within 300 mm of the ceiling, the dividers should be considered as if they reached the ceiling and the sections should be considered as separate rooms. A clear space of at least 500 mm should be kept in all directions below each detector.

For optical beam smoke detectors the 500 mm are generally measured perpendicular to the line of the beam except where the beam passes through holes in obstacles in the line-of-sight.

The dimensions of any such hole shall be compatible with the particular detector in accordance with the manufacturer's instructions.

d) Ventilation and air movement.

Where the room ventilation rate exceeds 10 changes per hour or where air velocities exceed 5 m/s then dilution effects shall be considered and use of more sensitive detectors or other measures may be necessary. Increasing the density of normal sensitivity detectors is not generally sufficient. In many cases a two stage response is used whereby the high sensitivity detectors signal for the air handling to be turned off such that normal sensitivity detectors can operate. This two stage response may be achieved by two alarm thresholds within the same detector.

If detectors have two (or more) alarm thresholds then the alarm which triggers the Fire Alarm state in the CIE shall comply with the relevant part of the EN 54 series.

The use of exploratory means (such as smoke tracers) to detect the air flow pattern and to determine suitable siting is recommended in such cases.

Point type detectors should not be mounted close to the air supply and extract grilles of air conditioning systems. Where the air inlet is through a perforated ceiling, the ceiling should be imperforate for a

radius of at least 0,5 m round each detector. Point type detectors should not be mounted within 0,5 m of any high velocity air condition (HVAC) grille where the air velocity is greater than 0,5 m/s.

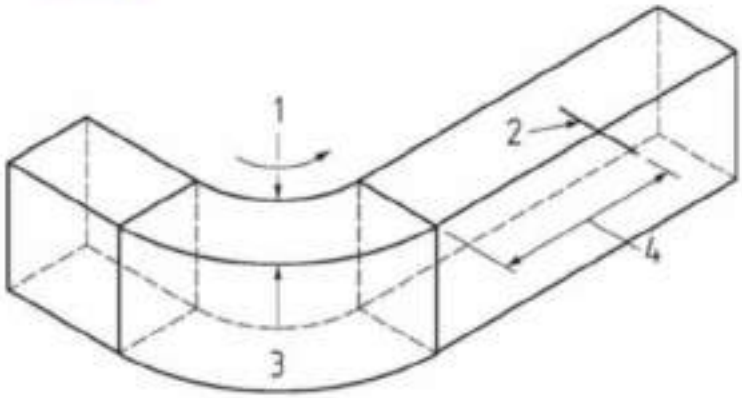
e) Detectors for air ducts.

Air duct smoke detectors shall comply with EN 54-27.

They may be used either to protect against the spread of smoke by an air conditioning system or as part of the local protection of machinery.

These detectors should only be considered as providing local cover or as supplementing a normal fire detection system.

In order to avoid the effects of air turbulence, smoke detectors or probes should be installed in a straight stretch of ducting, at a distance from the nearest bend, corner or junction of at least three times the width of the ducting (see Figure 2).



Key

1 airflow
2 detector probe
3 duct hight
4 minimum smoke detector installation distance from a duct bend, corner or junction

Figure 2 — Detector positioning in ventilation ducts

f) Ceiling irregularities.

Ceilings having irregularities with depths less than 10 % of the ceiling height should be treated as if they were flat and the radius limits of 6.5.2 should be applied.

Any ceiling irregularity (such as a beam) having a depth greater than 10 % of the ceiling height should be treated as a wall, and the following requirements shall apply:

$D > 0{,}25(H\text{-}h)$: detector in every cell;

$D < 0{,}25(H\text{-}h)$: detector in every second cell;

$D < 0{,}13(H\text{-}h)$: detector in every third cell;

where

D is the distance between the beams (m), measured from outside to outside;

H is the ceiling (or void) height (m);

h is the depth of the beam (m).

An illustration of the room height and beam depth is presented in Figure 3.

If the ceiling arrangement is such as to form a series of small cells (as in a honeycomb), then, within the radius limits of Table 1, a single point-type detector may cover a group of cells. The internal volume of the cells covered by a single detector should not exceed:

for heat detectors: $V = 6\ m^2 \times (H\text{-}h)$;

for smoke detectors: $V = 12\ m^2 \times (H\text{-}h)$.

Key

H ceiling (or void) height (m)

h depth of the beam (m)

Figure 3 — Illustration of room height and beam depth

In rooms with false floors, the ceiling height of the room should be measured from the upper surface of the false floor.

In voids above false ceilings, the void height (H) should be measured from the upper surface of the false ceiling that forms the floor of the void.

Depending on the fire load and the distribution of the fire load in the void, the siting and spacing of the detectors should be determined by a risk analysis.

g) Detection in voids above false ceilings.

Where a room has a false ceiling or there is some other similar horizontal void, the necessity of protecting the void by automatic detectors depends on the fire load density present (including the construction of the ceiling itself), and the presence and the fire resistance of cables of the fire detection and alarm system within the void.

If the fire load in the void exceeds 25 MJ/m² the void shall be protected by automatic detectors.

If the fire load in the void is between 15 MJ/m² and 25 MJ/m² in any one square metre and there are cables of the FDAS which are not fire resistant within the void, then the void shall be protected by automatic detectors.

If the fire load in the void does not exceed 15 MJ/m² in any one square metre then the void need not be protected by automatic detectors. In this case, cables of the FDAS within the void shall the fire resistant or shall be separated from other power cables in the void by a minimum of 0,5 m

If the void has an area larger than 200 m² then it is not allowed to divide the fire load by the area but cable ducts with a fire load of more than 25 MJ/m² in any on square metre shall be protected by automatic detectors mounted directly above or adjacent to the cable duct. These detectors shall not be further apart than 5 m.

h) Detection of spaces below perforated false ceilings.

Detectors above a perforated false ceiling may be used for protection of the area below the false ceiling if either:

1) the perforations are substantially uniform, appear across the complete ceiling and throughout they make up more than 40 % of the surface; and

2) the minimum dimension of each perforation exceeds 10 mm × 10 mm, and

3) the thickness of the ceiling is not greater than three times the minimum dimension of each perforation.

or

it can be demonstrated to the satisfaction of interested parties that the perforated false ceiling allows for the movement of smoke and heat to the true structural ceiling above such that the additional effect of the false perforated ceiling on the time of detection is not significant.

In all other cases, detectors should be mounted below the false ceiling, and if protection of the void above the false ceiling is necessary [see g)], further detectors should be installed on the true structural ceiling within the void.

Consideration should be given to the influence of air flow within the void and through the false ceiling on the efficacy of the detection arrangements. Such cases require individual consideration based on the type, number and area of the perforations, the type and quantity of combustible, and the degree of ventilation which might push or pull smoke through the false ceiling.

i) Detection below false floors.

Where rooms have false floors, detectors shall be mounted below the floors in accordance with the recommendations given for voids above false ceilings.

Special considerations should be given to the use of floor voids for ventilation (see 6.5.1 d)) and the relatively higher fire loads present in the floor voids due to power and data cabling.

Point type detectors shall be mounted in such a way that the smoke sensitive element inside the detector is within the top 10 % of the height of the void. For aspirating type detectors the sampling holes shall be positioned within the top 10 % of the height of the void.

NOTE In low voids this is often achieved by mounting the detector inverted to the normal mounting orientation by using some form of bracket.

j) Detectors not under ceilings.

In the absence of a ceiling or stratification layer, the fire products will be confined to the rising plume above the fire. If heat or smoke detectors are used to detect fire products in the rising plume (such as where optical beam detectors are used at low levels in atria, or where detectors are used without ceilings) then the limits of operating height should be as given in Table 1 and the effective operating radius (for either heat or smoke detectors) should be taken as 12,5 % of the height of the detector above the highest likely seat of fire.

6.5.2 Heat and smoke detectors

6.5.2.1 General

The coverage of each detector should be defined taking into account the following factors:

a) area protected;

b) distance between any point in the surveyed area and the nearest detector;

c) proximity of walls and similar obstructions;

d) height and configuration of the ceiling;

e) ventilation air movement;

f) any obstructions to the movement of fire products.

Special care should be taken that the beams of optical beam smoke detectors are not obstructed.

6.5.2.2 Heat detectors

The maximum radius of detection for a heat detector is 4,5 m.

For an open area square array of detectors the detectors may be spaced at a maximum distance of 6,4 m apart from each other and spaced no more than 3,2 m from a wall or major obstruction.

In corridors of width not exceeding 2 m, only points close to the centre line of the corridor need be considered, and accordingly the above recommendations will be satisfied if heat detectors are sited at intervals of 9,0 m, with the maximum dimension from the end wall being 4,5 m.

If the protected area has a pitched ceiling, for detectors at or near the apex, the horizontal distances given above may be increased by 1 % for each degree of slope, up to a maximum increase of 25 %.

6.5.2.3 Smoke detectors

The maximum radius of detection for a smoke detector is 6,2 m.

For an open area square array of detectors the detectors may be spaced at a maximum distance of 8,8 m apart from each other and spaced no more than 4,4 m from a wall or major obstruction.

In corridors of width not exceeding 2 m, only points close to the centre line of the corridor need be considered, and accordingly the above recommendations will be satisfied if smoke detectors are sited at intervals of 12,4 m, with the maximum dimension from the end wall being 6,2 m.

If the protected area has a pitched ceiling, for detectors at or near the apex, the horizontal distances given above may be increased by 1 % for each degree of slope, up to a maximum increase of 25 %.

Sampling holes for ASD are deemed to be equivalent to a point type detector.

Carbon monoxide fire detectors should be sited in accordance with all recommendations for smoke detectors.

6.5.3 Flame detectors

The coverage of each detector should be limited. Some factors to be taken into account in the limitation will be:

a) the line-of-sight distance between any point in the surveyed area and the nearest detector;

b) the presence of barriers to radiation;

c) the presence of interfering radiation sources.

Flame or radiation detectors should be sited to give good visual surveillance of the protected areas.

The quantity, positioning and adjustment of the flame detectors shall be such that an adequate and, as far as possible, uniform coverage is provided. Therefore, the required number of flame detectors is a function of the monitored volume and configuration of the space.

Because flame radiation spreads linear like light, a direct line of sight between each possible fire location and flame detector is essential.

The coverage of the flame detector(s) shall be documented on a plan drawing of the area to confirm that every point within the monitored area or hazard is within the view and range of at least one detector.

Table 2 — Class 1

Installation height of detector in m	Maximum monitoring area (A_{max}) in m² at different angles of optical axis of detector to vertical			
	0°-15°	15°-30°	30°-45°	45°-60°
1,5	15	25	40	40
1,5 - 2,5	60	80	90	100
2,5 - 3,5	120	140	150	160
3,5 - 4,5	180	190	210	210
4,5 - 5,0	240	250	260	260
5,0 - 5,5	280	280	280	300
5,5 - 6,0	330	320	320	330
6,0 - 7,5	380	360	360	350
7,5 - 9,0	420	410	390	360
9,0 - 12,0	440	430	390	340
12,0 - 35,0	440	440	440	440
35,0 - 40,0	440	440	440	440

Table 3 — Class 2

Installation height of detector in m	Maximum monitoring area (A_{max}) in m² at different angles of optical axis of detector to vertical			
	0°-15°	15°-30°	30°-45°	45°-60°
1,5	15	25	40	40
1,5 - 2,5	60	80	90	100
2,5 - 3,5	120	140	150	160
3,5 - 4,5	180	190	210	210
4,5 - 5,0	240	250	260	260
5,0 - 5,5	280	280	280	300
5,5 - 6,0	330	320	320	330
6,0 - 7,5	380	360	360	350
7,5 - 9,0	420	410	390	360
9,0 - 12,0	440	430	390	340
12,0 - 22,5	440	440	440	440
22,5 - 24,0	440	440	440	360

Table 4 — Class 3

Installation height of detector in m	Maximum monitoring area (A_{max}) in m² at different angles of optical axis of detector to vertical			
	0°-15°	15°-30°	30°-45°	45°-60°
1,5	15	25	40	40
1,5 - 2,5	60	80	90	100
2,5 - 3,5	120	140	150	160
3,5 - 4,5	180	190	210	210
4,5 - 5,0	240	250	260	260
5,0 - 5,5	280	280	280	300

Installation height of detector in m	Maximum monitoring area (A_{max}) in m² at different angles of optical axis of detector to vertical			
	0–15°	15°-30°	30°-45°	45°-60°
5,5 – 6,0	330	320	320	330
6,0 – 7,5	380	360	360	350
7,5 – 9,0	420	410	390	360
9,0 – 12,0	440	430	390	340
12,0 – 14,0	410	400	350	300
14,0 – 14,5	380	350	300	250
14,5 – 15,0	350	310	250	210
15,0 – 16,0	300	270	170	130
16,0 – 17,5	250	220	170	130
17,5 – 20,0	190	170	130	100

The assignment of the maximum permissible edge lengths of the box to the class of flame detector is shown in Figure 4.

In two-detector dependency type B the detectors shall be adjusted with different viewing angles on the same monitoring area.

In rooms with ceiling heights higher than 26 m RH monitoring areas of flame detectors shall be defined separately.

Flame detector EN 54-10	maximum edge length (a,b,R_H)	D_O (Maximum distance to the farthest point in the area*)
class 1	26 m	45 m
class 2	20 m	33 m
class 3	13 m	23 m
*) corresponds to maximum edge length (a,b,R_H) x $\sqrt{3}$		

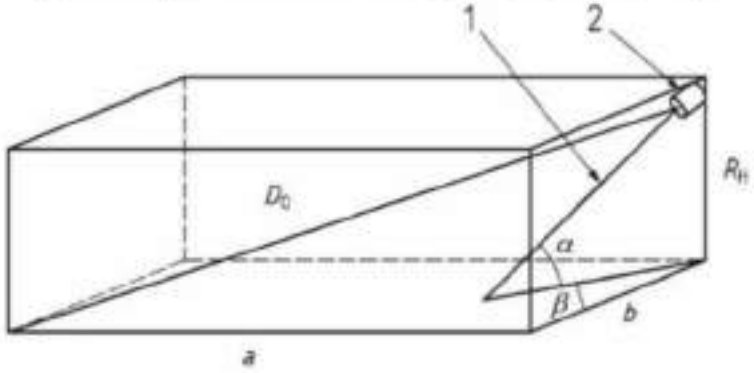


Figure 4 — Alignment and surveillance area of flame detectors installed at room corners and on the wall

6.5.4 Manual call points

Manual call points should be sited on escape routes, at (inside or outside) each door to escape stairs and at each exit to the open air. They may also be sited near special hazards and/or fire fighting equipment.

Additional care in siting manual call points may be necessary where there are people who have limited mobility, are incapacitated or require special care. Manual call points should be clearly visible, identifiable and easily accessible.

NOTE Special arrangements may be appropriate in areas where manual call points are likely to be subject to thoughtless or malicious operation, subject to the agreement of the relevant enforcing authority.

In general, manual call points should be fixed at a height of between 0,9 m and 1,4 m above the floor (1,2 m is preferred) and conform to EN 54-11. (For type and class local regulations may apply.)

6.5.5 Identification

The control and indicating equipment shall identify the detection zone and a location aid is required (see 6.7.4). It may also additionally identify the individual detector or manual call point from which an alarm has been raised. In such a case, a method shall be provided by which the control and indicating equipment indication can be related to the relevant detector.

If detector labels are used to provide the necessary cross-relation between detectors/manual call points and the control and indicating equipment, then identification numbers or letters should be attached to or adjacent to the detectors and manual call points duplicating the indications given at the control and indicating equipment. This identification should be legible from the floor, without requiring the use of ladders or similar equipment. If the detectors are hidden (e.g. above false ceilings or under floors) then duplicate identifications should be provided which are visible from the floor.

The following levels of identification are defined. For selection of the appropriate level local regulations may apply:

— Level 1 – no identification beyond the zone number, detector identifier and name/description within the CIE;

— Level 2 – Level 1 PLUS a requirement to label individual devices with a cross reference to the description within the CIE – e.g. could be a small label or text visible to maintenance personnel only;

— Level 3 – Level 1 PLUS a requirement to provide labelling which is legible from the floor giving a cross reference to the description within the CIE.

6.5.6 Coincidence detection

Coincidence detection can be used to minimize unwanted alarms or to provide a confirmed alarm prior to actuating alarms, routing equipment, fire protection equipment or voice alarm systems (Function C, E, G and M in EN 54-1).

Coincidence detection which is a normal function of systems such as extinguishing systems are not covered by this clause.

If coincidence detection is used the following shall apply:

— Manual Call Points shall not be included in a co-incidence configuration.

— Detectors configured to give a coincidence alarms shall be in the same room/area.

— Heat detectors shall not be included in a co-incidence configuration unless there are specific risks to be addressed and a risk assessment has been done and agreed.

— Consideration shall be given to the processing delays for each input to the coincidence arrangement.

— The two inputs to the coincidence arrangement shall be independent and are usually positioned at different locations.

— Ensure that in the case of one input being disabled or in fault the second input (when activated) will override the coincidence and will trigger the output(s) (see EN 54-2:1997, 4.1.8).

6.6 Alarm systems and devices

6.6.1 General

The method of giving the alarm to the occupants of the building should comply with the requirements of the fire alarm response strategy.

NOTE Fire alarm response strategies differ markedly across Europe it is important that this is clearly documented before a design can proceed.

Any alarm intended to be perceived by untrained persons (such as the general public) should be at least by audible means. These shall be alarm devices or a voice alarm system in accordance with CEN/TS 54-32.

In areas where audible alarms may be ineffective, e.g. where the background noise is excessive, or where hearing protection is likely to be worn, visual and/or tactile alarm devices shall be used to supplement audible alarms.

In areas which are likely to be occupied solely by hearing impaired people procedures for informing them of the alarm shall be in place and/or visual and/or tactile alarm devices shall be used to supplement audible alarms.

6.6.2 Audible Alarms

Components for audible alarms, public address, and voice alarm systems shall comply with EN 54-3, EN 54-16 and EN 54-24.

The installation of voice alarm systems shall comply with CEN/TS 54-32.

The following requirements refer to audible alarm sounders only:

— The sound level provided should be such that the fire alarm signal is immediately audible above any ambient noise but the sound level should not exceed 118 dB(A) at any point where people are likely to be present.

— The sound used for fire alarm purposes shall be the same in all parts of the building.

— The fire alarm sound should have a minimum level of either 65 dB(A), or 10 dB(A) above any other noise likely to persist for a period longer than 30 s, whichever is the greater. If the alarm is intended to arouse sleeping persons then the minimum sound level at the bedhead should be 75 dB(A).

— These minimum levels shall be reached at any point at which the alarm sound is required to be heard.

On a campus or site with multiple buildings the alarm sound should be the same for all buildings.

— If required, sound levels shall be measured using an instrument complying with EN 61672-1, Class 2 (or better), with slow (1s) response and 'A' weighting.

— In general fire alarm tone/signal shall be used for other purposes only if the response required is identical to that which would be required in case of a fire. If any other response is required then the fire alarm tone/signal shall not be used unless it is accompanied by other information.

6.6.3 Visual fire alarm devices

Visual fire alarm devices shall comply with EN 54-23. Any visual fire alarm should be clearly visible and distinguishable from other visual signals used in the premises (see also 6.6.1). Visual alarm devices should be numbered and positioned in such a way that they can be clearly seen from any point in the area they are used for.

6.7 Control and indication

6.7.1 General

The CIE shall comply with the requirements of EN 54-2.

6.7.2 Location of control and indicating equipment

6.7.2.1 Siting of the CIE

a) Indicating equipment (e.g. CIE, repeat or fire brigade panels), in conjunction with suitable manual control facilities should be sited at an appropriate location for both staff and firefighters responding to a fire signal. This should normally comprise an area on the ground floor close to the entrance to the building likely to be used by the fire and rescue service, or a suitably sited, continuously manned control room from which at least initial control of any fire incident, by staff and/or the fire and rescue service, will be implemented. In complex premises, there should be consultation between the user or purchaser (or others acting on their behalf) and the fire and rescue service, regarding the siting of all CIE and the facilities provided. Where there are multiple entrances to a complex building, there should also be consultation with the fire and rescue service regarding the possible need for repeat control and/or indicating equipment.

   NOTE There may be national requirements on the acceptance of the location by the fire brigade.

b) The CIE shall be located at a height which allows all indications to be viewed and control functions to be operated without the use of mechanical access equipment.

c) The height of the display and indications shall be, for desktop applications, a minimum of 890 mm from the floor level. For all other applications, the height of the display and indications shall be a minimum of 1,4 m and a maximum of 1,8 m from finished floor level. Due care shall be taken to ensure that the viewing angle allows easy readability by all operators and responsible persons (including special needs requirements). Where a special needs requirement exists, the provision of duplicate controls and displays should be considered.

d) Control and indicating equipment should preferably be located in an area that is normally manned when the building is occupied. Where this is not possible a simple remote display should be provided in a normally manned area or means provided to transmit signals to responsible persons.

e) Where control and indicating equipment is remote from the entrance used by the fire brigade there shall be signs directing to the location of the control and indicating equipment. This requirement should be considered in the consultations of 5.2.

6.7.2.2 Requirements on the room where the CIE is located

The room where the control and indicating equipment is located should:

a) have a small risk of fire (e.g. low fire load and minimal risk of ignition);

b) be covered by at least one fire detector within the system;

c) be clean and dry;

d) have a low risk of mechanical damage to the equipment;

e) be large enough so as not to restrict persons operating or maintaining the CIE;

f) have sufficient lighting such that visual indications can be clearly seen, controls easily operated and any instructions or legends easily read. Where necessary, additional artificial lighting shall be provided to give appropriate lighting level. Emergency lighting should also be considered on access routes to and at the CIE and Repeater Panels;

g) have an ambient noise level that does not prevent audible indications (such as the fault warning sounder) from being heard.

6.7.2.3 Control and indicating equipment in more than one cabinet (distributed CIE)

If the control and indicating equipment, or parts of it, is/are in more than one cabinet, then:

a) the location of each cabinet shall satisfy the relevant recommendations given in 6.7.2.1 and 6.7.2.2;

b) electrical connections between the cabinets shall be suitably protected against fire and mechanical damage (see 6.12).

6.7.3 Repeat control and indication panels

Repeat control and indicating panels may be necessary to achieve the requirements given in 6.7.2.1 in which case they should be sited in accordance with the requirements given in 6.7.2.1 and 6.7.2.2. These clauses do not apply to repeat indicating panels which are provided as additional indicators (i.e. not required to achieve the requirement of 6.7.2.1).

6.7.4 Alarm location aids

It shall be possible to quickly, easily and unambiguously relate the indications of the control and indicating equipment to the geographical location of any zone with a detector or manual call point in alarm to ensure fast and accurate directions to the relevant zone in the event of an alarm. Thus, in addition to the display of the detection zone on the CIE, at least one of the following shall be provided:

a) detection zone cards; or

b) detection zone maps; or

c) mimic panels;

The level of detail on the zone map will depend on the complexity of the building and the capability of the detection system installed but it should, where possible identify the locations of individual devices (which may or may not be addressable) and any particular hazards.

In systems where multiple zone maps or zone cards are necessary it should be possible to identify the relevant alarm map or card quickly using an appropriate index, list or matrix.

Zone cards may be two sided with the first side providing directions to the detection zone and the second side showing the details within that zone.

In special situations one or both of the following means may be necessary.

d) control and indicating equipment (CIE) with text display describing the location of addressable points;

e) a map of the active and passive fire protection measures in the building.

6.7.5 Fire brigade panel

In some countries a standardized panel is required for fire brigade use. The requirements for fire brigade panels are given in national documents.

6.8 Power supplies

6.8.1 Power supply equipment

The power supply for the CIE and for all other parts of the fire detection and fire alarm system shall comply with EN 54-4, except for those devices/components where the exception from EN 54-4 is clearly stated in the relevant product standard.

The output of the power supply equipment shall be sufficient to satisfy the maximum demands of the system.

6.8.2 Main power source

In general, the main power source for the system will be the public electricity supply system. Privately generated power may be used where it has at least the same reliability as the public supply or where no public supply system is available.

The main power supply to the fire detection system shall be provided with a suitable dedicated isolating protective device. That device shall not be used for other purposes and shall be clearly labelled (e.g. Fire Detection).

Provision shall be made (by, for instance, labelling such as DO NOT SWITCH OFF or the restriction of access) to prevent accidental disconnection of the main power source.

Where more than one power supply equipment is used, the power source for each equipment shall comply with these requirements.

6.8.3 Standby power source

In the event of failure of the main power source, standby power shall be available from at least a rechargeable battery (see EN 54-4). The capacity of this battery should be sufficient to supply the system for the standby time described below.

In some cases power may also be available from standby generators or uninterruptable power supplies. When such power is provided the standby time and thus the capacity of the battery may be reduced, but a dedicated battery shall always be provided.

Battery capacity is calculated as a function of the fault and alarm current and the standby time required.

Standby time is one of the following:

a) 24 h in fault warning condition plus 30 min alarm for systems which are permanently manned or where fault signals are automatically transmitted to a permanently manned fault receiving centre;

b) 72 h in fault warning condition plus 30 min alarm for systems which are not permanently manned and where fault signals are not automatically transmitted to a permanently manned fault warning receiving centre;

c) Or the standby time may be calculated on the basis of a risk assessment taking into account at least the following:

   1) time to discover a fault in the power supply and call for service/repair;

   2) time for maintenance personnel to repair the system and reinstate quiescent condition;

   3) availability of spare parts on site;

   4) The consequences of an unresolved power supply fault.

6.9 Signals to a fire alarm receiving station

The link to a fire alarm receiving station shall comply with EN 54-21.

NOTE There are national regulations for connecting FDAS to the alarm receiving stations.

6.10 Signals to a fault warning receiving station

The link to a fault warning receiving station shall comply with EN 54-21.

NOTE There may be private or national regulations for connecting FDAS to the fault warning receiving stations.

6.11 Other equipment or systems

Signals from the CIE may also be used to trigger, directly or not, the operation of equipment providing ancillary functions, such as:

a) fire extinguishing function;

b) compartmentation functions (e.g. smoke or fire doors);

c) smoke control function;

d) voice evacuation function;

e) ventilation shut-down;

f) lift control;

g) security doors.

Operation or malfunction of an item of ancillary equipment shall not jeopardize the correct functioning of the fire detection and fire alarm system, or prevent the giving of a signal to other ancillary equipment.

NOTE There are requirements in EN 54-2 for triggering and displaying these functions (specifically functions G and M).

6.12 Transmission paths

6.12.1 Cables

6.12.1.1 Cable types

Cables shall satisfy any requirements specified by the manufacturer or supplier of the equipment. Particular attention shall be paid to the current-carrying capacity and the attenuation of data signals.

6.12.1.2 Protection against fire

Where possible, cables should be run in areas with no fire load (other than the cables themselves). If it is necessary to run cables through other areas, and failure of those cables will prevent any of the following:

a) reception of a detection signal by the control and indicating equipment;

b) reception of a signal from a manual call point by the control and indicating equipment;

c) operation of alarm devices;

d) reception of signals between the fire detection system and any control for fire protection equipment;

e) reception of signals between the fire detection system and any fire alarm routing equipment;

f) reception of signals between the fire detection system and any voice evacuation system;

then either:

1) fire-resistant cables should be used:

Standard fire-resisting cables should meet the PH 30 classification when tested in accordance with EN 50200:2015 and additionally the 30 min survival time when tested in accordance with Annex E of that standard.

Enhanced fire-resisting cables should meet the PH 120 classification when tested in accordance with EN 50200 and the 120 min survival time when tested in accordance with BS 8434-2.

For fire detection and fire alarm systems for applications as listed below, cable systems comprising "enhanced" fire-resisting cables, with appropriate methods of support and jointing, should generally be used:

i) in unsprinklered buildings (or parts of buildings) in which the fire strategy involves evacuation of occupants in four or more phases;

ii) in unsprinklered buildings of greater than 30 m in height;

iii) in unsprinklered premises and sites in which a fire in one area could affect cables of critical signal paths associated with areas remote from the fire, in which it is envisaged people will remain in occupation during the course of the fire. Examples may be large hospitals with central control equipment and progressive horizontal evacuation arrangements, and certain large industrial sites;

iv) in any other buildings in which the designer, specifier or enforcing authority, on the basis of a fire risk assessment that takes fire engineering considerations into account, considers that the use of enhanced fire-resisting cables is necessary.

Methods of cable support should be non-combustible and such that circuit integrity will not be reduced below that afforded by the cable used, and should withstand a similar temperature and duration to that of the cable, while maintaining adequate support.

or:

2) the consequences of fire do not jeopardize the objective of the FDAS

The following clauses provide recommendations for achieving this goal:

i) Either:

I) Cables may be protected by burying within the structure of the building, or;

II) Installing cables inside conduit, ducting or trunking made of metal or protective plastic

ii) Or:

I) Cables used for FDAS should be separated from other cables by at least 0,5 m, and;

II) Cables are only installed in areas protected by automatic fire detection

iii) In addition to these requirements;

I) If signal paths are connected with loop cabling then isolators shall be provided at least at the detection zone boundaries and such that the functions of MCP, detection and alarm are also protected by isolators within the same zone so as to achieve the requirements of 6.2.2.1.

ll) If signal paths are connected with spur line cabling then automatic detectors, manual call points and sounders shall be installed on different spur lines and be kept within a single fire compartment.

If in the event of fire the following cables need to function for an extended period:

g) Interconnections from the low voltage mains supply distribution board to the power supply unit of the CIE and any other power supply units used as part of the FDAS;

h) interconnections between a control and indicating equipment and any separate power supply unit; including cables between alarm devices and their power supply;

i) interconnections between separated parts of a distributed CIE;

j) interconnections between a main control and indicating equipment and any mandatory repeat control panel;

they shall be given suitable protection to be able to function for 30 min:

This can be achieved by one of the following methods:

1) using cables with an PH 30 performance as specified in EN 50200;

2) protecting the cable by fire-resisting construction designed to provide a performance of EI 30.

6.12.1.3 Protection against mechanical damage

Cables should be adequately protected.

If cables are installed in cable trays, trunking, ducts, etc. they should be separated from other cables. They should not be installed in the same tray as low voltage cables. If there is only one tray for extra low voltage and low voltage cables, they shall be separated from low voltage cables by a metal physical barrier.

If the cables are installed directly on the ceiling or on a wall, they shall be put in plastic conduit, which is fixed to the wall or ceiling every 50 cm horizontally or 75 cm vertically, unless the cables have PH 30.

6.12.1.4 Protection against electromagnetic interference

The choice of cable and routes selected need to take into account the need to avoid electromagnetic interference from other cables and sources of electromagnetic radiation, particularly in the case of systems in which cables are used for transmission of data (such as addressable device circuits).

To avoid electromagnetic interference with fire alarm signals, any recommendations by the manufacturer of the fire alarm equipment in respect of separation of fire alarm cables from the cables of other services should be followed.

6.12.2 Radio linked systems

6.12.2.1 Radio linked transmission paths

As an analogy to cables, radio linked components rely on the whole environment for reliable transmission of signals. Care should be taken to ensure that there is sufficient signal strength which may be affected by many factors. For example, structural elements, electronic devices, furniture and any metalwork within the environment can have a significant effect on the transmission path to each radio linked component.

At the time of commissioning and after the installation of all equipment, including remote antenna(e), the following records relating to the radio data should be recorded:

a) the system coding (i.e. system address) which should, where possible, be unique to avoid the possibility of interference from similar systems on the same frequency;

b) details of the signal levels, (or signal to noise ratios) received at, or from, each of the receiver units.

These data should include signal levels, (or signal to noise ratios) relating to all the radio devices and the background noise level, and confirmation that these signal levels, (or signal to noise ratios) are in compliance with the manufacturer's recommendations. In the case of a networked system (i.e. multiple panel system), this should also include the signal levels, (or signal to noise ratios) for the radio-links between panels.

In addition to any other servicing recommendations in other parts of this standard, this should be undertaken at each routine service visit.

The signal levels, (or signal to noise ratios) recorded should be within the specifications set by the manufacturer of the radio system. If not within the specification, appropriate remedial action should be undertaken.

A copy of the signal levels should be kept on site with the system logbook.

6.12.2.2 Batteries

Only batteries according to the manufacturer's specification (as marked on the component) shall be used.

6.13 Protection against electromagnetic interference

In order to prevent damage and false alarms, equipment shall not be sited in places likely to have high levels of electromagnetic interference, i.e. levels higher than those the equipment has been tested. Where this cannot be arranged, then adequate electromagnetic protection shall be provided.

To avoid electromagnetic interference with fire alarm signals, any recommendations by the manufacturer of the fire alarm equipment in respect of separation of fire alarm cables from the cables of other services should be followed.

Throughout the installation, (including within the equipment cabinet), low voltage (LV, ≥ 50 V AC) and extra low voltage (ELV, ≤ 50 V AC) cables should be kept separate to the extent practicable and in accordance with national regulations.

6.14 Documentation

The designer shall provide sufficient documentation to enable the installer to carry out the installation satisfactorily. As a minimum, this should be layout drawings showing the intended type and location of all devices, and a schematic diagram showing their interconnections. Additionally the documentation should include:

a) information on the choice of detector for each area;

b) information and explanation of the actuation of function C in EN 54-1 (fire alarm function);

c) information and explanation of the actuation of function E in EN 54-1 (fire alarm routing function);

d) information and explanation of the actuation of function G in EN 54-1 (control function for fire protection system or equipment);

e) information and explanation of the actuation of function M in EN 54-1 (control and indicating function for alarm annunciation – voice alarm system);

f) Any other functions as defined in EN 54-1.

The designer shall provide and sign a confirmation of design. A model confirmation is given in Annex B.

If changes are made subsequent to the supply of the initial documentation, then these amendments and any new documentation shall be similarly documented (see 7.1).

6.15 Responsibility

Responsibility for planning, design, and the completeness and accuracy of the documentation of 6.14 should be clearly defined as in 4.5.

6.16 Qualifications

The person or organization carrying out the design and preparing the documentation of 6.14 shall have adequate theoretical and practical knowledge to be able to carry out the necessary work.

NOTE In some European countries there may be mandatory certification requirements for the design of systems.

7 Installation

7.1 General

The system shall be installed in accordance with the documentation prepared under 6.14. If for any reason the design prepared under Clause 6 is found unsuitable during installation, then any changes found necessary shall be agreed by the original designer or another suitably qualified person and agreed amendments made to the documentation, including the confirmation of design.

7.2 Siting of equipment

7.2.1 General

The positioning of the devices shall be in accordance with the design documentation.

7.2.2 Hazardous areas

Siting of equipment shall take account of any special hazards which might exist.

NOTE Attention is drawn to the requirements of the ATEX Directive for locations with a potentially explosive atmosphere.

7.3 Cable installation

7.3.1 General

Cables shall be installed in accordance with the requirements of 6.12 and the national and international regulations.

7.3.2 Cable identification

All cables used for the fire detection and alarm system should be of a single, common colour that is not used for cables of general electrical services in the building, to enable these cables to be distinguished from those of other circuits.

NOTE The colour red is preferred.

It is recommended that a cable identification system is employed to assist in the management and maintenance of the FDAS.

7.3.3 Multi-core cable restrictions

Loops of detectors or alarm devices should employ a separate and distinct route for the feed and return path, i.e. 4-core or mutli-core cable should not be employed to carry both the feed and return cable cores.

Each spur line for detectors, alarm devices or interconnection between CIE. should employ a separate cable and not be included in any multi-core cable.

It should be assumed that any fault that affects a multicore cable will affect all conductors of the cable; this precludes the use of multicore cable.

7.3.4 Cable joints and terminations

Joints in cables, other than those contained within enclosures of equipment, shall be avoided wherever possible. Where a joint in a cable is unavoidable, it shall be enclosed in a suitable, accessible and identifiable junction box to avoid confusion with other services.

Jointing and termination methods shall not result in any reduction in reliability compared to an unjointed cable.

7.4 Radioactivity

Handling, storage and use of detectors containing radioactive material are subject to requirements of national legislation.

7.5 Documentation

For maintenance and record purposes, drawings (or other appropriate records) shall be provided by the installer to the purchaser showing the position of the various items of equipment, junction boxes, etc. Wiring diagrams of junction boxes and distribution cases shall be included. The records should be permanent and suitable for convenient reference.

The installer shall supply the purchaser with a confirmation of installation and a log book. A model confirmation and logbook are given in Annex B.

7.6 Responsibility

Responsibility for compliance of the installed system with the documentation of 6.14 and 7.5 rests with the person or organization, signing the confirmation of installation.

7.7 Qualifications

The person or organization carrying out the installation and preparing the documentation of 6.14 and 7.5 shall be competent.

NOTE In some European countries there may be mandatory certification requirements for the installation of systems.

8 Initialization and configuration

8.1 General

The initialization and configuration of a fire detection and alarm system is often performed by a different person or organization than the installer e.g. particularly where complex cause and effect plans are used. This section defines the responsibilities of this activity.

8.2 Programming of the CIE

The configuration of the system shall comply with the requirements of the design, this guideline and the fire protection strategy for the building.

During configuration it shall be checked that all detectors, devices, and the cause and effect matrix for all mandatory and/or ancillary devices, inputs and outputs (functions C, E, G, J and M described in EN 54-1) are programmed as intended by the design.

8.3 Documentation

Appropriate records shall be provided to describe the configuration of the FDAS. The records shall be permanent, suitable for convenient reference and shall identify the person and organization that configured the FDAS.

8.4 Responsibility

Responsibility for compliance of the configured system with the documentation of 8.3 rests with the person and organization that configured the FDAS.

8.5 Qualifications

The person or organization carrying out the configuration and preparing the documentation of 8.3 shall be suitably competent to be able to carry out the necessary work.

NOTE In some European countries there may be mandatory certification requirements for the configuration of the system.

9 Commissioning acceptance and verification

9.1 General

The aim of the commissioning, acceptance and verification process is to determine that the installed system meets the requirements as determined under 5.2 and documented under 5.6.

There may be more than one organization involved in the process.

Commissioning and/or verification may be monitored by and form the basis for 3rd party certification.

9.2 Commissioning

The commissioning provider shall make a thorough visual inspection to ensure that the work has been carried out in a satisfactory manner, that the methods, materials and components used comply with these guidelines and that records, drawings and operating instructions are true to the installed system.

The commissioning provider shall test and confirm that the installed system operates correctly, (in fire alarm, fault and disablement condition) and in particular should check that:

a) all detectors and manual call points are located and identified correctly, are of the correct type and function correctly;

b) the information given by the control and indicating equipment is correct and meets the requirements documented under 5.6;

c) any connection to a fire alarm receiving station or fault warning receiving station is prepared or in operation and that the messages are correct and clear;

d) the alarm devices operate as required in these guidelines;

e) the actual power consumption of the FDAS complies to the necessary standby time;

f) all ancillary functions (inputs and outputs) have been tested;

g) the records, documents and instructions required under 7.5 and 8.3 have been provided and are accurate;

h) all alarm location aids are correct.

An example of a checklist for commissioning is given in Annex E.

Acceptance and handover

On completion of the system, arrangements need to be made for formal handover of the system to the purchaser, (or user) and formal acceptance of the system by the purchaser (or representative of the purchaser).

Before accepting the handover of the system, the purchaser or a representative needs to ensure that they are satisfied with the installed system, that the user has an adequate understanding of the operation of the system and the measures necessary to prevent false alarms, and that relevant documentation has been provided. In the case of small, simple systems, or systems installed in the premises of small organizations with little relevant in-house expertise, acceptance might involve little more than a brief inspection of the system by the user, demonstration of its operation by the commissioning engineer, and handover of the relevant documents to the user. In large, complex systems, it is likely that the purchaser will wish to witness relevant tests, as part of a formal and structured acceptance procedure.

As evidence of acceptance, an acceptance confirmation needs to be signed by the purchaser.

i) A purchase specification should define the acceptance procedures required by the purchaser, including any tests that are to be witnessed and details of the witnessing procedure, e.g. notice to be given;

j) Before accepting a system, the purchaser (or appropriate representative of the purchaser) should ensure, at least, the following:

   1) that all installation work appears to be satisfactory;

   2) that the system is capable of giving a fire alarm signal;

   3) that any facility for remote transmission of faults and alarms to an alarm receiving centre operates correctly;

   It is essential that any alarm receiving centre to which fire alarm signals are relayed be notified before, and immediately after completion of, any tests that could result in a fire alarm signal.

   4) that the following documents have been provided to the purchaser or user:

      i) as-fitted drawings;

      ii) operating and maintenance instructions;

      iii) confirmations of design, installation and commissioning;

      iv) a logbook in which all events, including fire alarm signals, fault signals, system tests and maintenance visits can be recorded;

   5) that a suitable diagrammatic representation of the premises is provided close to all CIE;

   6) that sufficient representatives of the user have been properly instructed in the operation of the system, including, at least, all means of triggering fire signals, silencing and resetting the system and avoidance of false alarms;

NOTE In the case of large, complex systems, this is likely to necessitate a formal training course for a number of people; the requirements for such training need to be defined in the purchase specification.

7) that the premises management has been advised of their responsibilities and how these might be discharged;

8) that all relevant tests, defined in the purchase specification, have been witnessed;

Some, or all, of these tests may be witnessed when commissioning is carried out, although this would be less appropriate in large, complex systems.

k) As evidence of acceptance, the purchaser (or appropriate representative of the purchaser) should sign an acceptance confirmation.

9.3 Verification (optional)

Where a purchaser or user considers that, as a result of division of responsibility for the design, supply, installation and commissioning processes, there is significant potential for the installed system to deviate from the recommendations of these guidelines, verification of compliance should be arranged.

In this case a preliminary period is specified in order to observe the stability of the installed system in the usual ambient conditions following acceptance of the installation.

Any person responsible for verification should be competent in the design of fire detection and fire alarm systems in accordance with these guidelines and familiar with the relevant installation practices.

Verification of the fire detection and alarm system will normally be carried out by the commissioning provider and the purchaser or his agent. Where there are requirements for third party inspection the requirements of Clause 10 shall be followed.

The scope and extent of the verification process should be agreed between the purchaser or user and the organization responsible for verification and should address the recommendations of 4.3 and Annex A.

On completion of verification, a verification confirmation should be issued, verifying that the system conforms to the recommendations of these guidelines, or identifying variations from these recommendations. The confirmation should also contain information on the scope and extent of the verification carried out or identify where this information is available.

A model confirmation is given in Annex B.

9.4 Responsibility

Responsibility for commissioning rests with the commissioning provider.

Responsibility for acceptance and handover rests with a third party such as a project manager.

Responsibility for verification rests with the third party responsible for verification.

9.5 Qualifications

Commissioning, acceptance and verification service providers should be appropriately competent, experienced and qualified. In particular, they should have knowledge of the characteristics of the system being installed and of the requirements of this guidelines.

10 Third party approval

10.1 General

Approval of an installed system will usually be based on an initial examination, together with continuing periodic examination to ensure that the system has been correctly used, maintained and, where necessary, modified.

There may be national regulations for mandatory third party approval.

10.2 Approval procedures

10.2.1 General

The various stages at which inspection and testing of the system being installed should be agreed by the third party and the installer and/or purchaser.

10.2.2 Inspection and testing

The inspection may be carried out by the approval body or by another organization acceptable to the approval body.

Inspection and testing is intended to confirm compliance with these guidelines and any local building regulations and permits.

Inspection and testing procedures will be based on the commissioning and verification procedures described in Clause 9.

10.2.3 Testing of operation

Where the testing will involve signals being sent to ancillary services or equipment, precautions should be taken so that test signals do not result in unforeseen or damaging operations (such as the unwanted release of extinguishant).

The system will have been in operation under normal conditions of use for a period as determined by the local authority before final approval is given.

NOTE Six weeks is a period generally considered as reasonable.

10.3 Documentation

The approving body should give a written confirmation of approval of the installed system. Where variations from these guidelines have been agreed, the confirmation should contain a list of the agreed variations. A reference to this confirmation should be given in the system logbook.

If the approving body decides that approval cannot be given, then a written notice of the deficiencies of the system should be given.

10.4 Periodic inspection by an approving body

10.4.1 General

The approving body, the authority having jurisdiction or the fire and rescue services may require periodic inspections to be made as a condition of continuing approval.

10.4.2 Documentation

A confirmation of the periodic inspection should be provided. The inspection should be recorded in the system logbook.

Where changes are required as a result of the inspection, these should be notified in the confirmation. The notification may specify a time limit for the completion of these changes, and may reserve the right to re-inspection after completion.

If the approving body decides that approval should be restricted or withdrawn because of deficiencies of the system, then a written notice of those deficiencies should be given.

10.5 Qualifications

The inspecting organization should be competent and have adequate theoretical and practical knowledge to be able to carry out examinations of the system.

NOTE If this approval body is an accredited inspection body the necessary competence is defined in EN ISO/IEC 17020.

11 User responsibilities

11.1 General

One or more identifiable persons shall be appointed to carry out the following functions:

NOTE There may be national regulations specifying the qualification and requirements for such personnel.

The user is responsible for a general awareness of issues in the premises that may affect the correct operation of the fire detection and fire alarm system.

The responsibility for carrying out the following functions can rest with different people. The name(s) of the person(s) shall be recorded in the log book, and kept up to date. Some or all of the following functions may be delegated by contract to a third party (such as an installing or servicing organization).

— laying down procedures for dealing with the various alarms, warnings and other events originating from the system;

— training of people who are authorized to operate the CIE;

— preventing false alarms, by taking adequate measures to prevent activation of the detectors by cutting, welding, sawing, smoking, heating, cooking, exhaust fumes, etc.;

— ensuring that the system is suitably modified if any significant changes of use or configuration of the building occur;

— ensuring that, where necessary, a suitable zone map is displayed and is kept up-to-date;

— keeping a logbook, and recording all events resulting from or affecting the system;

— ensuring that maintenance (see Clause 12) is carried out at the correct intervals;

— ensuring that the system is properly serviced after the occurrence of a fault, fire, or other event which might adversely affect the system.

11.2 User scheduled maintenance

NOTE There may be national requirements for the scheduled testing of alarm devices in addition to the following requirements.

11.2.1 Daily user maintenance

Ensure that the CIE is checked at least once every 24 h to confirm that there are no new faults on the system and that the green quiescent indicator is illuminated.

Check the log book for any new events and take appropriate action.

This is particularly appropriate if there are systems that allow intervention by others before the responsible person is on site.

11.2.2 Quarterly user maintenance

The following should be subject to continuous surveillance but as a minimum there should be a quarterly inspection of the building by the user to ensure the following:

— a clear space of at least 0,5 m around and below each detector;

— no obstructions which might hinder the movement of fire products towards the detectors;

— access to manual call points is not obstructed and that spare glasses are available;

— correct function of the backup power supply by isolating the mains supply to the CIE by operation of the dedicated isolating protective device, (see 6.8.2).

11.2.3 Annual user maintenance

The intervals of annual user maintenance for the different parts of the FDAS are given in Annex D, Table D.1.

11.3 Documentation

The logbook shall be kept in a place only accessible to authorized persons (preferably at or near the control and indicating equipment). A record shall be kept in this logbook of all events concerning the installed system. A suggested form of logbook is given in Annex B.

12 Maintenance

12.1 General

To ensure the continued correct functioning of the installed system, the system shall be regularly inspected and serviced. Arrangements for this shall be made immediately on completion of the installation whether the premises are occupied or not.

In general, an arrangement shall be made between the user and/or owner and an organization which is competent to conduct the maintenance (including inspection, servicing and repair) of the installed system.

Maintenance shall be done according to national requirements.

NOTE There may be national requirements for the certification of maintenance service providers.

12.2 Maintenance routine

12.2.1 General

An inspection and servicing routine shall be adopted. This routine is intended to ensure the continuing correct functioning of the system under normal circumstances.

A suitable maintenance routine is given in Annex D.

12.2.2 Prevention of unwanted fire signals to the fire and rescue service during maintenance

It is important to ensure that maintenance operations do not result in a false alarm.

If a link to a remote manned centre is present and enabled during the test, then it is essential to notify the centre before undertaking the test.

The occupants of the premises should be notified prior to any test of the system that may result in the alarm devices being operated.

12.2.3 Prevention of unwanted activation during routine testing

It is important to ensure that maintenance operations do not result in unwanted activation of fire protection equipment.

If a link is provided to other fire protection equipment then either the link or the other equipment shall be disabled for the duration of the test, unless the test is intended also to be a test of the other equipment.

Where the fire alarm system will automatically operate fire doors or similar equipment, care should be taken that the occupants are informed of the possible effects of the testing.

12.2.4 Precautions during maintenance

If during maintenance detectors are put into test mode the following should apply:

— The detection zones of not more than one fire compartment should be put into test mode.

— Special care should be taken to ensure a human response to a real fire originating in an area that is in test mode (people should be made aware that the fire detection and alarm systems is temporarily disabled in this area).

12.3 Corrective maintenance

In the event of:

a) any indication of a fault of the system;

b) any suspicion of a possible fault of the system (for example after a fire event);

c) damage to any part of the system;

d) any fault that has been identified during servicing or inspection;

the user and/or owner shall arrange for the rectification/repair of the system at the earliest opportunity.

12.4 Spares

It may be convenient for a supply of spares to be held on site. At least a minimum of the following spare parts should held within the premises:

a) Six frangible elements and appropriate tools for manual call points, unless there are less than 12 manual call points in the protected premises in which case only two spare frangible elements with appropriate tools;

NOTE This is not necessary if resettable manual call points are used.

b) If the CIE is equipped with an internal printer, printer supplies, (paper, etc.);

c) For larger premises, (more than 1 000 detectors) it will be sensible to ensure the availability of a spare copy of the system log book;

d) such other spare parts agreed between the user and the organization responsible for maintenance of the system.

12.5 Documentation

Work carried out on the system shall be noted in the logbook. On completion of the work a maintenance confirmation should be issued (see Annex D).

Any identified deficiencies of the system shall be notified to the responsible person in written form.

12.6 Responsibility

The user and/or owner of the installed system shall ensure that maintenance of the fire detection and alarm system is carried out.

The responsibility for maintenance itself lies within the organization doing the maintenance work.

12.7 Qualifications

Maintenance should only be carried out by an organization which is qualified for the maintenance (including inspection, servicing and repair) of the installed system.

13 Modification of an installed system

13.1 General

All modifications to the installed system (whether extensions or alterations) shall be done in conformance with this standard and agreed by interested parties.

13.2 Third party approval

Where the installed system is the subject of approval by a third party, the following shall apply:

If the modification is significant then it should be reported in writing to the third party which will decide the subsequent procedure. What is significant shall be determined by risk assessment (or by guidelines such as if more than 10 detectors, or more than 600 m^2 are subject to modification).

13.3 Extent of compliance

Any modification to a system designed to these guidelines shall be such that the resulting installed system still complies with these guidelines.

If a system was designed and installed to a previous version of these guidelines then wherever possible, modification should not increase the degree of non-compliance within the area initially covered AND in an extension of the system, the extended part of the system should comply completely with these guidelines and the following shall apply:

In particular, care should be taken that the power supply is adequate for the modified system.

13.4 Documentation

Modifications carried out on the installed system should be noted in the logbook.

The system documentation should be updated.

13.5 Responsibility

The installer of the modifications should ensure that any modification is in compliance with these guidelines.

13.6 Qualifications

Modifications shall only be carried out by an organization which is appropriately qualified.

14 Operation of other fire protection systems

14.1 General

The fire detection and alarm system may be used to provide initiating signals to other fire protection systems, such as:

a) automatic fire extinguishing systems;

b) smoke and heat control systems;

c) systems for triggering the release and closing of fire doors;

d) voice evacuation systems.

NOTE For some of these systems European product standards and installation guidelines will apply.

Operation or malfunction of another fire protection system shall not jeopardize the correct functioning of the fire detection and alarm system, or prevent the transmission of a signal to any other system.

The recommendations or requirements given in the documentation of the other fire protection system should be followed.

14.2 Responsibility

In addition to the responsibilities laid down under 6.15, 7.6 and 8.4, special care shall be taken by the designer, installer and maintainer to ensure that the fire detection and alarm system neither impairs nor is impaired by the system or devices to be triggered.

Close liaison shall be maintained between the designers of the fire detection system and the other fire protection system, and the boundaries of their respective responsibilities shall be defined.

The requirements of both systems shall be specified in sufficient detail to allow correct design of the interface between the two systems.

15 Applications in special risks

15.1 General

Special risks are those requiring particular attention and knowledge in the design and choice of equipment, the siting and spacing of detectors, or the arrangement of circuits.

Such risks may include, for example:

a) electronic data processing areas;

b) high-racked warehouses;

c) atrium and high ceiling areas;

d) hazardous areas;

e) outdoor risks;

f) high value risks.

15.2 Electronic data processing areas

The following items should be given special attention in the design of fire detection systems for rooms containing electronic equipment such as computers or telephone exchange equipment:

a) effects of high ventilation rates and high air speeds on detection (see also 6.5.1 d);

b) needs for fire detection in concealed spaces such as above false ceilings and below false floors and the airflows within such spaces;

c) arrangements for controlling ventilation and air conditioning;

d) closing of fire shutters and dampers in response to signals from the fire detection system;

e) arrangements for modification of air handling in the event of a fire.

Special types of detectors (such as aspirating systems) may be appropriate, particularly where local cover of computer cabinets or air handling return grilles, etc., is provided.

15.3 High-rack warehouses

15.3.1 General

Because of the wide range of types of high-rack storage and of the possible contents, early consultation with the user and/or owner and other interested parties (insurers, architects, authorities, etc.) is essential.

Special care should be taken in the planning of the fire strategy to ensure that the possible effects of high fire spread rate are taken into account. The primary purpose of the fire detection system is to evacuate personnel. Where early intervention is intended, high sensitivity detection supported by an adequate response strategy is necessary.

Fire can spread quickly in a high-rack warehouse so high-rack storages are usually protected by some form of automatic extinguishing system (such as sprinklers). It may therefore be necessary to consider interlinking between the detection and extinguishing systems.

In terms of fire detection, high-rack storage is defined as when the highest level of the stored goods exceeds 9,0 m.

Aspirating smoke detection systems are recommended for detection in high-rack warehouses.

Where the high-rack storage is particularly high the considerations applicable to Atria may apply (see 15.4).

15.3.2 Aspirating smoke detection

There should be at least one aspirating smoke detector per aisle mounted on the outside of racking or located in the centre between two racks.

One aspirating smoke detector should not cover a horizontal distance of more than 30 m.

The spacing distance between sampling points should not exceed 6,5 m.

In addition to detection mounted on the rack, at least one aspirating smoke detection system should either be mounted on the ceiling or mounted with sampling points 1 m above the top level of the stored goods.

15.3.3 Other detection

Point smoke detection systems are not recommended in this application.

Beam smoke detection is also not normally suitable due to activity in the rack spacing causing interference and false alarm signals.

15.4 Atrium and high ceiling areas

In atrium buildings it is important that all fire protection measures (including fire compartmentation, smoke and heat control, fire suppression, etc., as well as the fire detection and fire alarm system) are coordinated, and that their interactions are properly controlled. The requirements of these guidelines should be taken only as a starting point; additional detection (or unusual configurations of detectors) may be necessary.

In atria the fire load is usually restricted to the floor level such that it is not necessary to monitor the whole height. Linear beam detectors should be used.

NOTE The risk arising from a temporary fire load at higher levels, (for example sales banners) is likely to be a negligible risk.

Linear beam detectors should be mounted at an adequate height (9 m – 12 m is recommended). Since the detectors are not within the 10 % zone the maximum horizontal distance between two detectors is 25 % of the installation height.

If detectors are mounted on the ceiling and there is concern regarding the effect of stratification, supplementary angled beam detectors may be considered appropriate.

15.5 Hazardous areas

In some buildings there may be hazards (e.g. explosive, chemical, biological or nuclear) which may have significant effects on the design of the system. In such cases very close cooperation is necessary between the purchaser (who should be aware of the hazard) and the designers and installers of fire detection and alarm systems.

NOTE For fire detection and alarm equipment used in areas with an explosive hazard, attention is drawn to the requirements of the ATEX Directive (94/9/EC).

15.6 Outdoor areas

Where all or part of a fire detection and fire alarm system is installed in an outdoor area, special attention should be paid to:

a) environmental conditions;

b) choice and siting of detectors;

c) avoidance of false alarms.

Manual call points in outdoor areas shall be suitable for outdoor use.

Point-type smoke detectors are not usually suitable for outdoor applications.

15.7 High value risks

In some buildings there may be artefacts, processes or equipment which have an intrinsically high value. That value may be due to the rarity or direct value of a particular object, or to the consequential costs of interruption to a critical process or it may be that even a very small fire would result in unacceptable damage. In such cases the recommendations given in this guidelines, which are primarily intended to define the minimum requirements to provide detection and alarm in the event of a fire, are unlikely to be appropriate and additional or more comprehensive protection will be required. It is not in the scope of this guidelines to specify what form the additional protection shall take.

NOTE The following are commonly used:

a) provision of automatic fire suppression systems (e.g. sprinklers, watermist, gaseous systems);

b) a tight regime to control and minimize the fire load and ignition sources in the area containing the high value risk;

c) provision of early detection (e.g. that provided by Class A or B ASD systems) supported by appropriate response procedures and firefighting equipment;

d) interlinking of the detection systems to early control measures (e.g. by opening smoke vents early to minimize the risk of smoke damage or by removing power from the affected process/equipment);

e) oxygen reduction systems.

15.8 Responsibility

In addition to the purchaser's responsibility under 5.7 and 5.8, the designers responsibility under 6.14 and 6.15, the designer and user and/or owner should ensure that all necessary information needed for the assessment of the special risk is made available. This information will usually include the fire alarm response strategy for the risk.

16 Integrated systems

These guidelines do not cover integrated systems.

17 Hierarchical and networked systems

Distributed CIE as defined in EN 54-2 are considered as a single CIE with regard to these guidelines.

Hierarchical systems are frequently used in places where a main site is sub-divided into a number of smaller parts; for instance in shopping centres, large hospitals or campus sites.

Where there are several separate buildings on a common site, each may require its own system for fire detection and alarm, but with the facility to provide status information to a centre on the site.

In large buildings, economy of cabling may be achieved by the use of a number of subsidiary control and indicating equipment, each providing fire detection and/or alarm functions for a defined part of the building but additionally communicating with a centre within the building and/or with each other.

Where such systems are to be installed the designer shall:

a) ensure mutual compatibility;

b) define suitable working procedures (including procedures for resetting, silencing, isolation, etc.);

c) define and specify any remote links;

d) define system responsibilities;

e) the equipment used and the circuit design should be such that indications are given at the manned centre at least;

f) identifying any subsidiary control and indicating equipment in its fire alarm condition;

g) identifying any condition of a subsidiary control and indicating equipment in which a fire alarm could be prevented (such as fault or disabled conditions);

h) identifying any failure of a link to a subsidiary control and indicating equipment which might prevent the reception of a fire alarm at the manned centre.

Requirements for other control and indication facilities should be determined from the consultations of 5.2.

Where networked systems are used without a hierarchical structure special care should be taken to avoid conflicting control signals. All system events should be recorded in a single common log book.

Annex A
(informative)

False alarms

A.1 Causes of false alarms

It is essential that the utmost care should be taken by system designers, installers and users to reduce the incidence of false alarms.

False alarms may be the result of poor equipment, poor system design, poor installation, poor usage or poor maintenance. They may also result from adverse environmental conditions or a change of use not taken into account in the system design.

Common causes of false alarms include the following (not necessarily given in order of importance):

a) work being carried out in a protected area without knowledge of, or in neglect of, the necessary precautions such as disabling detectors;

b) ambient conditions such as heat, smoke, flame, steam or dust from cooking or work processes or fumes from engine exhausts;

c) mechanical and electrical faults, often resulting from the effects of vibration, impact or corrosion;

d) servicing or testing work carried out without prior notification to the fire brigade or central alarm station;

e) electrical transients (such as from lightning or switch-on surges) or radio interference;

f) inadequate servicing;

g) the build-up of dust or dirt within a detector, or the entry of insects;

h) change of use or changes within the building without appropriate changes to the fire detection and alarm system;

i) accidental or malicious operation of manual call points or detectors.

A.2 Vulnerability of various detector types

A.2.1 Smoke detectors

False alarms signalled by smoke detectors may be caused by smoke and other fumes, dusts (including slow accumulations of dust and disturbed aerial dusts), fibres, steam or condensation; all these may be due to normal processes or activities or to unusual extremes of the environment. Insect infestation may be a significant problem.

Optical beam smoke detectors will often give false alarms if the beam is accidentally partially obstructed; apart from those obstructions due to human activities, obstructions due to perching by birds or by bats have been reported.

A.2.2 Heat detectors

False alarms may be caused by abnormal increases in temperature due to space heating equipment, industrial processes or sunshine. They may be prevented by installing detectors with appropriate higher temperature settings, or, in the case of direct sunlight, by introducing an appropriate shade.

False alarms from rate-of-rise heat detectors may also be caused by a rapid temperature increase to normal room conditions following exposure to low temperatures. Such a sequence may occur, for instance, in a loading bay with large doors to the outside; while the doors are open the detector may be exposed to winter conditions, followed by rapid heating when the doors are closed. If such conditions are likely, then detectors without a rate-of-rise response should be used.

A.2.3 Flame detectors

Ultraviolet flame detectors sense the ultraviolet radiation emitted by flames. They are liable to respond to sources such as lightning, ionizing radiation, ultraviolet lamps and quartz-halogen lamps unless the detection system can discriminate between various sources, but they do not respond to sunlight (the component of solar ultraviolet to which detectors would respond is filtered out by the high-altitude ozone layer of the earth's atmosphere). Known sources of ultraviolet light should be screened from the detector, taking care that the screen does not also obscure likely sites for fire. Ordinary window glass will screen ultraviolet radiation.

Most infrared flame detectors operate by detecting the flickering component of the infrared radiation from a fire. This type of detector should be insensitive to steady infrared sources such as very hot objects or sunlight, but may be operated if this steady light becomes modulated by, for example, moving tree branches or the blades of a fan. Infrared flame detectors may be made solar blind.

When used outside care should be taken to avoid false alarms initiated by reflections off water, glass, mirrors, sparks, etc.

A.3 Possible preventative measures

A.3.1 Multi-sensor detectors

The benefits of these systems depend on the algorithm used to make the fire decision. The increased amount of information coming from the combination of the sensed fire phenomena may reduce the number of false alarms caused by environmental conditions.

A.3.2 Pre-alarm warnings

In some types of system an early warning can be given of conditions which might (or might not) represent a fire. Such pre-warnings should not initiate a full fire alarm, but may be used to alert personnel, thus reducing the number of unwanted alarms and possibly providing an opportunity for early intervention when there is a small fire.

Such systems are particularly useful where the false alarms are caused by inappropriate work or activity in an area. In such cases signalling of the pre-alarm condition to personnel in the area affected (perhaps using an automatic voice warning) enables them to terminate the inappropriate work or to disable the detectors before the condition escalates to a false alarm.

Clearly such pre-alarm warnings are most effective when the detection system is able to provide early warning, i.e. the system can detect when "normal" conditions are no longer present as opposed to signalling when the conditions are approaching a full alarm threshold. Detectors with more than one alarm threshold with different sensitivities are appropriate (e.g. a multi-class Aspirating Smoke Detector).

A.3.3 Dependency on more than one alarm signal Coincidence detection

See EN 54-2:1997/A1:2006, 7.12.

There are several ways in which the dependency on more than one alarm signal may be implemented, but fundamentally the technique provides a confirmation alarm by withholding a full response or fire alarm signal until two automatic fire alarm signals have been received.

Such a technique can be effective for reducing false alarms.

A.3.4 Activity related systems

A.3.4.1 General

Where human or industrial activity during working or wakeful hours could result in false alarms, particularly where the presence and behaviour patterns of people make it unlikely that a fire would go undetected by human agency, it may be useful to consider an activity related system. Various options are available and each should be considered in the light of the fire risk and type of occupancy. No such options, for either new or existing systems, should be implemented until agreement has been reached under the procedures outlined in 5.2.

A few examples of activity related systems are listed below:

a) a system of pre-transmission confirmation (see A.3.4.2) may be used during working hours;

b) the simplest application could be for a system that switched from manual detection during the working hours to automatic detection in silent hours (i.e. outside working hours);

c) in a system which allows variable detection algorithms, it may be possible to use different algorithms (or change the recognition patterns) during working hours so that the system is less likely to give false operation in response to conditions which may commonly arise during working hours;

d) protection by smoke detectors in silent hours could be changed to heat detectors during working hours.

Any activity related system likely to result in an increased size of fire at the time of detection should be used only when trained staff are present on the premises and a risk assessment has been carried out.

In general switching to occupied hours should be manual and switching to a normal mode of operation should be automatic. The wish to minimize false alarms should be subordinate to the need to achieve the required level of protection during occupied hours. In commercial premises it may sometimes be acceptable for the automatic changeover to occur when the main access door is closed and locked for the night.

A.3.4.2 Pre-transmission confirmation

In some (but not all) circumstances where there is a high incidence of false alarms which cannot be reduced by other measures, it may be desirable to delay the automatic transmission of an alarm to the fire brigade for a sufficient time to allow the alarm to be investigated. For this purpose the inclusion in the control and indicating equipment of an output delay (permitted as an option with requirements under EN 54-2:1997/A1:2006, 7.11) may be considered.

NOTE There are different technical and/or organizational requirements on the pre-transmission confirmation in the European countries.

A.4 Investigation of false alarms

All false alarm events should be recorded in the system log book as a false alarm and this should include

a) The category of false alarm as following:

   1) alarms, in which a system has responded, either as designed or as the technology may reasonably be expected to respond, to any of the following:

      i) a fire-like phenomenon or environmental influence (e.g. smoke from a nearby bonfire, dust or insects, processes that produce smoke or flame, or environmental effects that can render certain types of detector unstable, such as rapid air flow);

      ii) accidental damage;

      iii) inappropriate human action (e.g. operation of a system for test or maintenance purposes without prior warning to building occupants and/or an alarm receiving centre);

   2) alarms, in which the false alarm from a fault in the system;

   3) alarms, in which a person operates a manual call point or causes a fire detector to initiate a fire signal, while knowing that there is no fire;

   4) alarms with good intent, in which a person operates a manual call point or otherwise initiates a fire signal in the belief that there is a fire, when no fire actually exists.

NOTE 1 When translating these categories please look at the content and use appropriate words:

— The detector identification and location that has caused the false alarm;

— Any information relating to the cause of the false alarm signal.

At regular intervals the log book shall be checked by a competent person and the total number of false alarms should be compared to the maximum acceptable false alarm rate. The maximum acceptable false alarm rate is calculated as following:

NOTE 2 An interval of 12 months has been proven to be practical.

A false alarm rate of one false alarm per one hundred automatic detectors per year is acceptable. However there should be a program that aims towards a constant reduction of false alarms with the ultimate target of zero false alarms.

If the maximum acceptable false alarm rate is exceeded it is recommended that the following actions are taken:

b) Evaluate false alarm entries in the logbook to establish if there is a pattern of events related to time or location.

c) Inspect the locations with the highest rate of false alarms and evaluate if the false alarms can be reduced at these locations by:

   1) a change of detector type or

   2) a change of location of the detector.

d) Give consideration to a change of procedures for the control and management of the Fire detection and alarm system that will reduce the incidence of false alarms. For example; disable detection in the vicinity of hot work in the premises.

e) Contact the maintenance provider for advice on modifications to the system that will reduce false alarm rate.

Annex B
(informative)

Model documents

This annex gives models for:

— confirmation of design;

— confirmation of installation;

— confirmation of commissioning and verification;

— confirmation of acceptance;

— system logbook.

Although the various confirmations are here shown separately, it is permissible for them to be combined into one or more document, or to be bound into the system logbook.

CONFIRMATION OF DESIGN

Protected area.....

Address of premises .....

.....Tel No.....

Designer's name: .....

Designer's address .....

.....

Tel No.: ..... E-mail address: .....

As recommended in 6.14 of CEN/TS 54-14:2018, the design work carried out and covered by this confirmation is shown on drawings numbers

.....

I/We hereby certify that the fire detection and alarm system at the above premises has been designed by me/us, and that the system as designed conforms to the requirements given in CEN/TS 54-14, (including the requirements covered in the documentation prepared under 5.6) except for such variations as have been agreed in compliance with 4.3 of CEN/TS 54-14:2018 and are listed below.

Extent of the system (5.3.2) .....

Signature of person responsible for design of the system.....

Position ..... Date.....

For and on behalf of .....

Details of variations from the requirements of CEN/TS 54-14 (or the numbers of documents in which the details are given):

Additional information:

Figure B.1 — Model confirmation of design

CONFIRMATION OF INSTALLATION

Protected area.....

Address of premises .....

.....Tel No.....

Installer's name.....

Installer's address .....

Tel No..... E-mail: .....

As recommended by 7.5 of CEN/TS 54-14:2018, the work carried out and covered by this confirmation is shown on drawing numbers:

.....

I/We hereby certify that the fire detection and alarm system at the above premises has been installed by me/us in accordance with the system designer's specification and as detailed in the confirmation of design, in accordance with Clause 7 of CEN/TS 54-14:2018.

Signature of person responsible for the installation of the system.....

Position ..... Date.....

For and on behalf of .....

Variations from the design specification:

Details of measurements/recordings relevant to the installation (Annex E item 24) - or the numbers of documents in which the details are given:

Additional information:

Figure B.2 — Model confirmation of installation

CONFIRMATION OF COMMISSIONING

Protected area.....

Address of premises .....

.....Tel No.....

System commissioned and tested by (Company).....

Address .....

.....

Tel No..... E-mail address: .....

I/We hereby certify that the fire detection and alarm system at the above premises has been inspected/tested by me/us in accordance with the system designer's specification, and that the system as inspected conforms to the requirements given in CEN/TS 54-14, except for such variations as are listed below.

Signature of person responsible for commissioning and testing the system

.....

Position .... Date.....................................

For and on behalf of ....

- -

Details of variations from the requirements of CEN/TS 54-14 and/or the systems designers specifications (or the numbers of documents in which the details are given).

Additional information:

Figure B.3 — Model confirmation of commissioning and verification

CONFIRMATION OF ACCEPTANCE

Confirmations and accompanying documentation covering the installation, commissioning and testing of the fire detection and alarm system at:

Protected area..

Address of premises ....

.... Tel. No. ....

have been received and accepted. Furthermore, my attention has been drawn to the recommendations of CEN/TS 54-14; in particular, to Clause 10 (Use of the system), Clause 11 (Maintenance) and Annex A (False alarms).

Operation of the FD&FA system has been demonstrated and staff have received adequate training in the operation and use of the system.

In accordance with 7.5 and 8.4, log book, record drawings, zone maps or zone cards and instructions for use, routine attention and maintenance of the system have been supplied, and received by:

Signed ....

Position ....

Date ....

For and on behalf of (purchaser) ....

Additional information:

Figure B.4 — Model confirmation of acceptance

SYSTEM LOGBOOK

Foreword

A responsible executive should be appointed to oversee or carry out all entries in this logbook. The name of this person (and any changes of responsible person) should be recorded.

Reference data

Name and address ....

....

Responsible person .... Date ....
.... Date ....
.... Date ....
.... Date ....

The system was installed by .....

and is maintained under contract by. .....

.....

until .....

Telephone number ..... E-mail address: ..... should be contacted if service is required.

Event data

All events (including fire alarms, false alarms, faults, pre-alarm warnings, tests, disablements, temporary disconnections, service visits and any other significant occurrences) should be properly recorded. A brief note of any work carried out or outstanding should be made.

Date	Time		Alarm counter reading	Event	Zone (detector)	Location	Reason /Action	Name and signature
	• OFF	• ON						

Expendable components:

.....

.....

.....

.....

Replacement due:

.....

.....

.....

.....

Figure B.5 — Model logbook

Annex C
(informative)

Model list of fire loadings for different cable types

The cable details and fire loading Figures shown in Tables C.1, C.2 and C.3 are included for illustrative purposes only and may be applied where more exact Figures are not available.

Table C.1 — Cables for voltages up to 1 000 V

Cable core and cross-section data						Cable type				
						Halogenated			Non-halogenated	
						NYM	NYY	NYCY/ NYCWY	NHXHX	NHXCX
n	mm²	n	mm²	n	mm²	MJ/m	MJ/m	MJ/m	MJ/m	MJ/m
1 x	1,5	-	-	-	-	0,61	-	-	-	-
1 x	2,5	-	-	-	-	0,79	0,79	-	0,79	-
1 x	4	-	-	-	-	0,9	1,2	-	1,0	-
1 x	6	-	-	-	-	1,0	1,2	-	1,0	-
1 x	10	-	-	-	-	1,3	1,2	-	1,0	-
1 x	16	-	-	-	-	1,51	1,51	-	1,4	-
1 x	25	-	-	-	-	2,09	2,09	-	1,91	-
1 x	35	-	-	-	-	-	2,41	-	2,09	-
1 x	50	-	-	-	-	-	2,92	-	2,48	-
1 x	70	-	-	-	-	-	3,31	-	2,92	-
1 x	95	-	-	-	-	-	4,21	-	3,71	-
1 x	120	-	-	-	-	-	4,72	-	4,1	-
1 x	150	-	-	-	-	-	5,67	-	5,0	-
2 x	1,5	-	-	-	-	1,51	2,48	-	2,48	-
2 x	2,5	-	-	-	-	1,91	2,81	-	2,81	-
2 x	4	-	-	-	-	2,41	3,6	-	3,2	-
2 x	6	-	-	-	-	2,7	4,0	-	3,6	-
2 x	10	-	-	-	-	4,21	4,72	-	4,28	-
3 x	1,5	-	-	-	-	1,58	2,7	-	2,81	-
3 x	2,5	-	-	-	-	2,09	3,0	-	3,1	-
3 x	4	-	-	-	-	2,6	3,9	-	3,6	-
3 x	6	-	-	-	-	3,31	4,4	-	3,9	-
3 x	10	-	-	-	-	4,61	5,1	-	4,61	-
3 x	16	-	-	-	-	5,51	6,1	-	5,51	-
3 x	25	-	-	-	-	8,6	8,9	-	8,1	-
3 x	35	-	-	-	-	10,0	7,7	-	9,22	-
3 x	50	-	-	-	-	-	9,4	-	11,5	-
3 x	70	-	-	-	-	-	11,1	-	14,2	-

Cable core and cross-section data						Cable type				
						Halogenated			Non-halogenated	
						NYM	NYY	NYCY/ NYCWY	NHXHX	NHXCX
n	mm²	n	mm²	n	mm²	MJ/m	MJ/m	MJ/m	MJ/m	MJ/m
3 x	95	–	–	–	–	–	14,6	–	18,5	–
3 x	120	–	–	–	–	–	16,1	–	21,2	–
3 x	150	–	–	–	–	–	19,5	–	26,1	–
4 x	1,5	–	–	–	–	19,1	3,0	2,81	3,2	2,81
		3 x	1,5	1 x	1,5	19,1	3,0	2,81	3,2	2,81
4 x	2,5	–	–	–	–	2,41	3,38	3,1	3,6	3,2
		3 x	2,5	1 x	2,5	2,41	3,38	3,1	3,6	3,2
4 x	4	–	–	–	–	3,31	4,5	4,0	4,1	3,6
		3 x	4	1 x	4	3,31	4,5	4,0	4,1	3,6
4 x	6	–	–	–	–	3,9	5,1	4,5	4,61	4,0
		3 x	6	1 x	6	3,9	5,1	4,5	4,61	4,0
4 x	10	–	–	–	–	5,4	6,0	5,3	5,4	4,8
		3 x	10	1 x	10	5,4	6,0	5,3	5,4	4,8
4 x	16	–	–	–	–	6,7	7,31	6,3	6,7	5,6
		3 x	16	1 x	10	6,7	7,31	6,3	6,7	5,6
		3 x	16	1 x	16	–	–	6,3	5,6	–
4 x	25	–	–	–	–	10,4	10,4	–	9,5	–
		3 x	25	1 x	16	–	9,6	9,1	8,71	8,3
		3 x	25	1 x	25	–	–	9,1	8,3	–
4 x	35	–	–	–	–	11,8	9,4	–	10,8	–
		3 x	35	1 x	16	–	9,6	8,0	9,7	9,4
		3 x	35	1 x	35	–	–	8,0	9,4	–
4 x	50	–	–	–	–	–	11,9	–	14,1	–
		3 x	50	1 x	25	–	11,9	10,0	12,7	12,0
		3 x	50	1 x	50	–	–	10,0	–	12,0
4 x	70	–	–	–	–	–	14,7	–	17,3	–
		3 x	70	1 x	35	–	14,6	11,8	15,5	14,8
		3 x	70	1 x	70	–	–	11,8	14,8	–
		3 x	70	1 x	70	–	–	11,8	14,8	–
4 x	95	–	–	–	–	–	18,4	–	22,5	–
		3 x	95	1 x	50	–	18,7	15,4	20,0	19,2
		3 x	95	1 x	95	–		15,4	–	19,2
4 x	120	–	–	–	–	–	20,5	–	25,7	–
		3 x	120	1 x	70	–	20,9	17,0	23,7	22,0
		3 x	120	1 x	120	–	–	17,0	–	22,0
4 x	150	–	–	–	–	–	25,1	–	25,7	–
		3 x	150	1 x	70	–	25,3	20,6	27,5	27,0
		3 x	150	1 x	150	–	–	20,6	–	27,0
5 x	2,5	–	–	–	–	2,1	3,4	3,1	3,7	3,2

Cable core and cross-section data						Cable type				
						Halogenated			Non-halogenated	
						NYИ	NYY	NYCY/ NYCWY	NHXHX	NHXCX
n	mm²	n	mm²	n	mm²	MJ/m	MJ/m	MJ/m	MJ/m	MJ/m
		4 x	1,5	1 x	1,5	2,1	3,4	3,1	3,7	3,2
5 x	2,5	–	–	–	–	2,7	3,9	3,5	4,1	3,7
		4 x	2,5	1 x	2,5	2,7	3,9	3,5	4,1	3,7
5 x	4	–	–	–	–	4,0	5,2	4,6	4,7	4,2
		4 x	4	1 x	4	4,0	5,2	4,6	4,7	4,2
5 x	6	–	–	–	–	4,6	5,9	5,2	5,3	4,7
		4 x	6	1 x	6	4,6	5,9	5,2	5,3	4,7
5 x	10	–	–	–	–	6,6	7,2	6,1	6,6	5,5
		4 x	10	1 x	10	6,6	7,2	6,1	6,6	5,5
5 x	16	–	–	–	–	8,3	8,6	7,5	7,8	6,8
		4 x	16	1 x	16	8,3	8,6	7,5	7,8	6,8
5 x	25	–	–	–	–	12,3	12,3	10,5	11,3	9,7
		4 x	25	1 x	16	12,3	12,3	10,5	11,3	9,7
		4 x	35	1 x	16	–	–	9,6	–	11,0
		4 x	50	1 x	25	–	–	12,4	–	14,4
		4 x	70	1 x	35	–	–	15,0	–	17,6
		4 x	95	1 x	50	–	–	19,2	–	23,2
		4 x	120	1 x	70	–	–	21,4	–	26,5
		4 x	150	1 x	70	–	–	26,0	–	32,3
6 x	1,5	–	–	–	–	2,4	–	–	–	–
7 x	1,5	–	–	–	–	2,4	3,9	–	4,2	–
7 x	2,5	–	–	–	–	–	4,4	–	4,7	–
7 x	4	–	–	–	–	–	6,0	–	5,4	–
12 x	1,5	–	–	–	–	–	5,6	–	6,1	–
12 x	2,5	–	–	–	–	–	6,4	–	7,2	–
12 x	4	–	–	–	–	–	9,1	–	8,3	–
19 x	1,5	–	–	–	–	–	7,4	–	8,5	–
19 x	2,5	–	–	–	–	–	8,8	–	9,7	–
19 x	4	–	–	–	–	–	12,3	–	11,3	–
24 x	1,5	–	–	–	–	–	9,2	–	10,3	–
24 x	2,5	–	–	–	–	–	10,6	–	11,8	–
24 x	4	–	–	–	–	–	15,6	–	14,3	–
37 x	1,5	–	–	–	–	–	12,2	–	14,1	–
37 x	2,5	–	–	–	–	–	4,0	–	16,7	–
37 x	4	–	–	–	–	–	21,7	–	19,9	–

Table C.2 — Telephone and data cables

Cable core and cross-section data		Cable type			
		Halogenated		Non-halogenated	
Number of wire pairs	Wire pair cross section	I-YY Bd	IE-Y(St) Y Bd	I-HH Bd	IE-H(ST)H Bd
n	mm²	MJ/m	MJ/m	MJ/m	MJ/m
2 x	0,6	0,4	-	0,8	-
4 x	0,6	0,6	-	1,2	-
6 x	0,6	0,8	-	1,4	-
10 x	0,6	1,0	-	1,9	-
16 x	0,6	1,4	-	2,9	-
20 x	0,6	1,6	-	3,5	-
24 x	0,6	1,8	-	4,0	-
30 x	0,6	2,4	-	4,9	-
40 x	0,6	2,9	-	6,2	-
50 x	0,6	3,4	-	7,2	-
60 x	0,6	4,2	-	8,6	-
80 x	0,6	5,1	-	11,0	-
100 x	0,6	6,1	-	13,4	-
2 x	0,8	-	0,7	-	1,0
4 x	0,8	-	1,0	-	1,4
8 x	0,8	-	1,5	-	2,1
12 x	0,8	-	2,1	-	3,1
16 x	0,8	-	2,6	-	-
20 x	0,8	-	3,0	-	4,2
24 x	0,8	-	3,4	-	-
28 x	0,8	-	4,2	-	-
32 x	0,8	-	4,6	-	6,4
36 x	0,8	-	5,0	-	-
40 x	0,8	-	5,4	-	7,5
44 x	0,8	-	5,8	-	-
48 x	0,8	-	6,6	-	-
56 x	0,8	-	7,4	-	-
60 x	0,8	-	7,7	-	-
64 x	0,8	-	8,1	-	-
68 x	0,8	-	8,5	-	-
72 x	0,8	-	8,9	-	-
76 x	0,8	-	9,8	-	-
80 x	0,8	-	10,2	-	-

Table C.3 — Cables for voltages over 1 000 V

Cable core and cross-section data				Cable type			
				Halogenated		Non-halogenated	
				NA2 x SEY	NYSEY	-	-
N	mm²	n	mm²	MJ/m	MJ/m	-	-
3x	35	1 x	16	37,0	38,0	-	-

Cable core and cross-section data				Cable type			
				Halogenated		Non-halogenated	
				NA2 x SEY	NYSEY	–	–
N	mm^2	n	mm^2	MJ/m	MJ/m	–	–
3x	50	1 x	16	42,0	42,0	–	–
3x	70	1 x	16	47,0	39,1	–	–
3x	95	1 x	16	53,0	53,0	–	–
3x	120	1 x	16	60,0	58,0	–	–

Annex D
(normative)

Maintenance routine

D.1 Maintenance works

D.1.1 The switch mechanism of every manual call point should be tested, either by removal of a frangible element, insertion of a test key or operation of the device as it would be operated in the event of fire.

Particular care should be taken to verify whether all manual call points remain unobstructed and conspicuous.

D.1.2 All automatic fire detectors and remote detectors should be examined, as far as practicable, to ensure that they are correctly labelled and that they have not been damaged, painted, or otherwise adversely affected. Thereafter, every detector should be functionally tested. The tests used need prove only that the detectors are connected to the system, are operational and are capable of responding to the phenomena they are designed to detect. Where fitted, detector remote indicators should also be checked for correct operation.

Every heat detector should be functionally tested by means of a suitable heat source, unless operation of the detector in this manner would then necessitate replacement of part or all of the sensing element (e.g. as in fusible link point detectors or non-integrating line detectors). Special test arrangements will be required for fusible link heat detectors. The heat source should not have the potential to ignite a fire; live flame should not be used, and special equipment might be necessary in explosive atmospheres.

Point smoke detectors should be functionally tested by a method that confirms that smoke can enter the detector chamber and produce a fire alarm signal (e.g. by use of apparatus that generates simulated smoke or suitable aerosols around the detector). It should be ensured that the material used does not cause damage to, or affect the subsequent performance of, the detector; the manufacturer's guidance on suitable materials should be followed.

Optical beam smoke detectors should be functionally tested by introducing signal attenuation between the transmitter and receiver, either by use of an optical filter (or any similar method of simulating obscuration by smoke), smoke or simulated smoke.

Aspirating fire detection and fire alarm systems should be functionally tested by a method that confirms that smoke can enter the detector chamber and produce a fire alarm signal. It should be ensured that the material used does not cause damage to or affect the subsequent performance of the detectors; the manufacturer's guidance on suitable materials should be followed.

Furthermore, appropriate testing should be performed to verify that smoke is able to enter each sampling point (or collection of sampling points that are recommended by the manufacturer to cover the same area as a point smoke detector).

This can be achieved by introducing smoke into each sampling point in turn and verifying a response at the detector. However, where access is restricted or other site conditions prevent this, other verification techniques should be employed such as:

a) verifying transport time from furthest hole or a dedicated test point and comparing with previously recorded results to identify deviations;

b) confirming that the flow monitoring is capable of detecting loss of a single sampling point (or collection of sampling points that are deemed to be acceptable for the risks involved);

c) inspection of flow readings and comparing with previously recorded results to identify deviations which would indicate a loss of detection performance;

d) measurement of the pressure at each sampling point and comparing with previously recorded results to identify deviations which would indicate a loss of detection performance;

e) The technique used is dependent on the particular features of the ASD technology, the risk and details of the specific application. Such techniques may also be supported by visual inspection of sampling points where this is possible but it is essential to verify that adequate detection performance is maintained.

Details of the techniques used should be recorded and agreed with all parties.

NOTE For further guidance see the FIA Code of Practice for Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) Systems [EN 54-10].

Carbon monoxide fire detectors should be functionally tested by a method that confirms that carbon monoxide can enter the detector chamber and produce a fire alarm signal (e.g. by use of apparatus that generates carbon monoxide or a gas that has a similar effect on the electro-chemical cell as carbon monoxide).

WARNING — Carbon monoxide is a highly toxic gas, and suitable precautions should be taken in its use.

It is necessary to ensure that any test gas used does not cause damage to, or affect the subsequent performance of, the detector; and that the manufacturer's guidance on suitable test gases is followed.

Flame detectors should be functionally tested by a method that confirms that the detector will respond to a suitable frequency of radiation and produce a fire alarm signal. The guidance of the manufacturer on testing of detectors should be followed.

In fire detection systems that enable analogue values to be determined at the CIE, it should be confirmed that each analogue value is within the range specified by the manufacturer.

Multi-sensor detectors should be operated by a method that confirms that products of combustion in the vicinity of the detector can reach the sensors and that a fire signal can be produced as appropriate. The guidance of the manufacturer on the manner in which the detector can be functionally tested effectively should be followed.

Remote indicators shall be checked for function and correct labelling.

Care should be taken to verify that an unobstructed free space of 0,5 m is around every automatic detector.

D.1.3 All fire alarm devices should be checked for correct operation. It should be confirmed that visual fire alarm devices are not obstructed from view and that their lenses are clean.

D.1.4 All unmonitored, permanently illuminated filament lamp indicators at CIE should be replaced.

The cause and effect programme should be confirmed as still being correct.

All conditions of EN 54-2 (alarm, fault warning, disablement and test condition) shall be tested including their correct indication on the CIE.

All functions necessary for the auxiliary indication panel shall be tested including their correct indication.

The correct function of the printer shall be checked along with the provision of sufficient supplies of print media.

D.1.5 Radio signal strengths in radio-linked systems to which 6.4.7 applies should be checked for adequacy, and the results recorded.

D.1.6 The alarm and fault warning condition current shall both be measured and used to verify that the standby power supply capacity remains suitable for the designed battery backup time.

D.1.7 Check the activation of all type G functions.

The testing shall be limited to a confirmation of the activation of the interface device and may exclude operation of the function of type H. It is recommended that during this testing that the user simultaneously undertakes a testing of the correct function of devices type H.

D.1.8 All conditions and functions of the standard applicable to the fire brigade panel shall be tested including their correct indication on the CIE.

On completion of the work, any outstanding defects should be reported to the user and a record of the inspection and test should be made on the servicing confirmation.

D.1.9 The correct functioning of the fire brigade key safe shall be checked including confirmation that the deposited general key or key card still unlocks all the doors.

D.1.10 Check the correct function of the alarm routing and fault warning routing devices by initiating a fire alarm event and fault alarm event and verifying the correct reception at the alarm receiving centre and / or fault warning receiving centre.

D.1.11 A visual inspection should be made to check whether structural or occupancy changes have affected the compliance of the system with the recommendations of these guidelines for the siting of manual call points, automatic fire detectors and fire alarm devices.

D.1.12 The system logbook should be examined. It should be ensured that any faults recorded have received appropriate attention. A visual inspection to ensure that the documentation required for the fdas is complete, accurate and up to date.

Table D.1 — Intervals for maintenance

		Interval for inspection by qualified company			Interval for inspection by user		
Parts of fdas	• Reference	Interval	Deviation as defined by manufacturer	Deviation site-specific	Interval	Deviation as defined by manufacturer	Deviation site-specific
Manual call point (D)	D.1.1	• 12			• 1		
• Accessibility to manual call points	D.1.1	• 12			• 1		
• Automatic detector (A)	D.1.2	• 12			• 3		
• Remote indicators	D.1.2	• 12			• 3		
• Labels	D.1.2	• 12			• 3		
• Free area around detectors	D.1.2	• 12			• 3		
• Alarm devices (C)	D.1.3	• 12			• 3		
• CIE. (B)	D.1.4	• 12			• daily		
• Function control	D.1.4	• 12			• –		
• Site-specific parameters	D.1.4	• 12			• –		
• Auxiliary indication panels	D.1.4	• 12			• 3		
• Printer	D.1.4	• 12			• 1		

		Interval for inspection by qualified company			Interval for inspection by user		
Parts of fdas	• Reference	Interval	Deviation as defined by manufacturer	Deviation site-specific	Interval	Deviation as defined by manufacturer	Deviation site-specific
• Radio signal strength	D.1.5	• 12			• 12		
• Power Supply (L)	D.1.6	• 12			• 3		
• Ancillary fire protection equipment (G)	D.1.7	• 12			• 12		
• Fire brigade panel (M)	D.1.8	• 12			• 3		
• Fire brigade key safe	D.1.9	• 12			• 3		
• Accessability	D.1.9	• 12			• 12		
• Routing device (E)	D.1.10	• 12			• –		
• Fault warning routing device (J)	D.1.10	• 12			• –		
• Usage	D.1.11	• 12			• 3		
• Documentation	D.1.12	• 12			• 3		
• Log-Book	D.1.12	• 12			• 1		

Telephone No.		Signature

D.2 Inspection and servicing confirmation

Confirmation of servicing for the fire detection and fire alarm system at:

Address:.....

.....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the servicing of the fire detection and fire alarm system, particulars of which are set out below, CERTIFY that the said work for which I/we have been responsible complies to the best of my/our knowledge and belief with the recommendations of Clause 12 of CEN/TS 54-14:2018 quarterly inspection of vented batteries/periodic inspection and test/inspection and test over a 12 month period (delete as applicable), except for the variations, if any, stated in this confirmation.

Name (in block letters):.....Position:.....

Signature: .....Date:.....

For and on behalf of: .....

Address:.....

.....Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by this confirmation:

.....

.....Variations from the

recommendations of Clause 12 of CEN/TS 54-14:2018 for periodic or annual inspection and test (as applicable):

.....

.....

.....

Relevant details of the work carried out and faults identified have been entered in the system logbook.

During the past 12 months .... false alarms have occurred. This equates to .... false alarms per 100 automatic fire detectors per annum.

The following work/action is considered necessary:

.....

.....

.....

.....*Please add additional pages if necessary*

Annex E
(informative)

Commissioning checklist

The Engineer will test and inspect the system to ensure that:

a) all manual call points and automatic detection devices operate correctly;

b) where required, all manual call points, automatic detection devices, fire alarm devices and ancillary devices are identified by labels or other means and correspond to supporting plans, maps and/or lists and their identification in the CIE;

c) every manual call point and automatic detection device on operation results in the correct zone indication and, in the case of addressable systems, correct text display, at all indicating equipment;

d) sound pressure levels of sounders and intelligibility of Voice Alarm systems throughout the building are in accordance with the specification/guidelines;

e) all visual alarms and parallel indicators are in accordance with the specification/ guidelines;

f) all remote signalling operates in accordance with the specification/guidelines;

g) that all detectors, devices, and the cause and effect matrix for all mandatory and/or ancillary devices, inputs and outputs (G, C and E in EN 54-1) function as intended;

h) all alarm, control, indicating, printing, and ancillary functions of the system operate correctly and are adequately labelled or identified;

i) any changes to the building, since the time of the original design, have not compromised the compliance of the system;

j) siting of manual call points complies with this guidelines as to location, height and visibility;

k) siting of point heat, smoke, and CO detectors complies with this guidelines;

l) siting of beam-type detectors complies with this guidelines;

m) siting of line-type detectors complies with this guidelines;

n) siting of aspirating smoke detectors complies with this guidelines;

o) siting of flame detectors complies with this guidelines;

p) siting of any smoke detectors for ventilation ducts complies with this guidelines;

q) in radio-linked systems radio signal strengths are adequate in all areas of the protected premises;

r) siting of any special detector complies with its specification;

s) siting of control, indicating and power supply equipment complies with this guidelines and any additional requirement by government, building laws, fire brigades or insurers where applicable;

t) suitable zone map(s) are available in the designated location;

u) mains power supplies are inspected and comply with the specification/guidelines;

v) stand by power supplies and the system's actual load currents fulfil the stand by time required;

w) as far as practicable the cable types and guidelines of workmanship is compliant with the specification/guidelines;

x) where required, adequate records of insulation resistance, earth continuity, and where appropriate earth loop impedance tests exist;

y) all fault indicators and their circuits should be checked, where practicable, by simulation of fault conditions;

z) all relevant documentation has been provided to the user or purchaser.

Annex F
(informative)

Test fires

In some situations it is necessary to verify the performance of the fire detection and fire alarm system in a particular environment. In such cases a simple test fire may be required.

NOTE These test fires are not intended to prove that a detector complying to the appropriate standard of the EN 54 series gives an alarm signal.

This is a complex subject, application of a simple pass / fail criteria for a test fire in a particular environment is not usually appropriate. An element of judgement will be required taking into account the many factors that contribute to the ultimate suitability of a particular fire detection solution. Designing test fires and making a judgement of the results should only be conducted by competent personnel.

This annex gives some principles and guidance in conducting these test fires.

The test fires performed are controlled real fires and do not consist of the test fires described in the individual product standards of the EN 54 series.

Wherever possible the material(s) burned in the test fire should be representative of the materials and fire risk that will be present in the normal working conditions of the site being evaluated (Hint: Using about 3 kg of material have been found to be suitable). Test fires should be ignited by a small ignition source that does not itself contribute to the heat energy developed. The materials used in the standard test fires, e.g. TF4 in EN 54-7, may be considered but they should be representative of the material likely to be found on the site under test.

In some cases artificial smoke could be used for a test fire, however such smoke lacks the dynamic behaviour of hot smoke and additional heat sources may be used to give the artificial smoke some buoyancy. The heat release rate of the additional heat source should match a typical fire expected on the site.

Test fires should be repeated several times to show that the results are consistent and representative.

The objective of the test fire should be established for example:

— to establish that the time of response of the installed fire detection and fire alarms system is comparable with that of an established known reference technique. For example, if a point type smoke detector could be mounted at a height that would be outside the recommendations of these guidelines, the response time should be compared with a detector type that does follow the recommendations.

— to demonstrate that the smoke is able to reach the detectors within a reasonable time. For example, where there is a possible stratification or movement of air due to air handling equipment.

Bibliography

[1] EN 54-2:1997/A1:2006, *Fire detection and fire alarm systems — Part 2: Control and indicating equipment*

[2] EN 54-13, *Fire detection and fire alarm systems — Part 13: Compatibility and connectability assessment of system components*

[3] EN 54-17, *Fire detection and fire alarm systems — Part 17: Short-circuit isolators*

[4] EN 54-18, *Fire detection and fire alarm systems — Part 18: Input/output devices*

[5] EN 54-26, *Fire detection and fire alarm systems — Part 26: Carbon monoxide detectors — Point detectors*

[6] EN 54-30, *Fire detection and fire alarm systems — Part 30: Multi-sensor fire detectors — Point detectors using a combination of carbon monoxide and heat sensors*

[7] EN 54-31, *Fire detection and fire alarm system — Part 31: Multi-sensor fire detectors — Point detectors using a combination of smoke, carbon monoxide and optionally heat sensors*

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

[9] EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

[10] EN 14604, *Smoke alarm devices*

[11] EN 14637, *Building hardware — Electrically controlled hold-open systems for fire/smoke door assemblies — Requirements, test methods, application and maintenance*

[12] EN ISO/IEC 17020, *Conformity assessment — Requirements for the operation of various types of bodies performing inspection (ISO/IEC 17020)*

[13] Directive 94/9/EC on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)