



BSI Standards Publication

Fire detection and fire alarm systems

Part 14: Guidelines for planning, design, installation,
commissioning, use and maintenance

National foreword

This Published Document is the UK implementation of CEN/TS 54-14:2018. It supersedes DD CEN/TS 54-14:2004, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/12/1, Installation and servicing.

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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,
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Instandhaltung

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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.

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

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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 1 to entry: 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 1 to entry: 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 1 to entry: 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 1 to entry: 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 1 to entry: 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 1 to entry: 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).

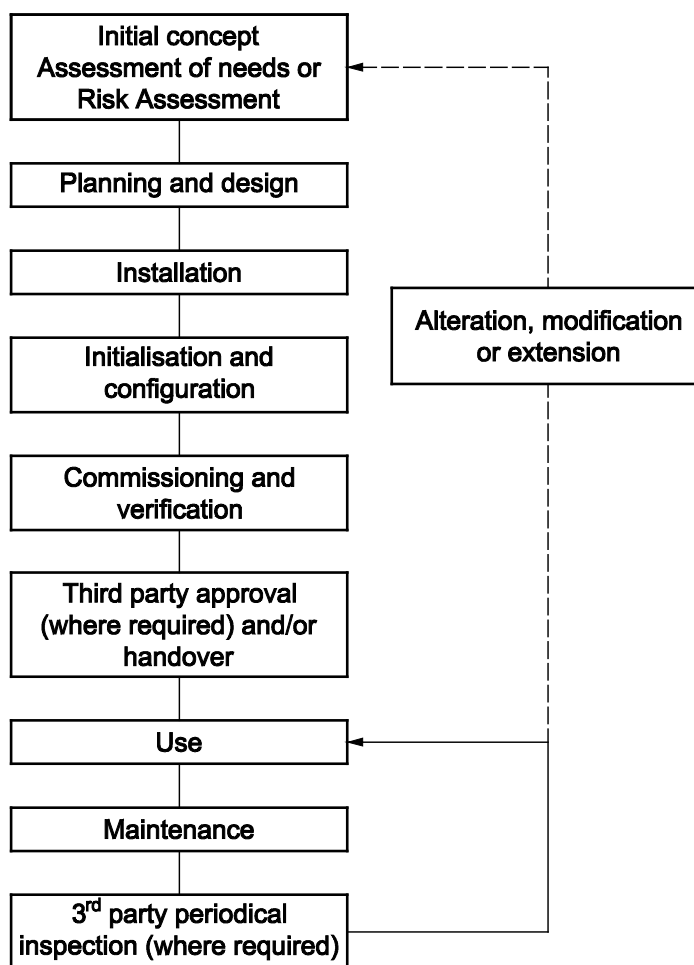


Figure 1 — Idealized system flow chart

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 m³;
- 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 m², 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 m² (see Annex C); and
 - 2) do not contain fire load densities in excess of 15 MJ of combustible material in any 1 m² (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 m², 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 m² 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 m².

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, CO₂, NO_x 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.