



VIETNAM NATIONAL STANDARD

TCVN 5738:2001

First Revision

**AUTOMATIC FIRE ALARM SYSTEM
TECHNICAL REQUIREMENTS**

(This English version is for reference only)

HANOI – 2008

Foreword

TCVN 5738 : 2001 replaces TCVN 5738 : 1993.

TCVN 5738 : 2001 was prepared by National Technical Committee TCVN/TC 21 “Fire Fighting and Prevention” and the Police Department of Fire Fighting and Prevention, proposed by Directorate for Standards, Metrology and Quality (STAMEQ), approved by Ministry of Science, Technology and Environment (now renamed as Ministry of Science and Technology).

This standard was transferred in 2008 from Vietnam standard into Vietnam National standard under the same identifier number, as stipulated in Section 1, Article 69 of the Law on Standards and Technical Regulations and in Point a, Section 1, Article 6 of Decree No 127/2007/ND-CP of the Government dated 01 August 2007 detailing the implementation of a number of articles of the Law on Standards and Technical Regulation.

Automatic Fire Alarm System – Technical Requirement

1. Scope.

This standard is applied for automatic fire alarm systems in manufactories, enterprises, stores, working places, hospitals, schools, theatres, hotels, markets, trade centers, armed force quarter and other works subjected to hazard of fire and explosion, etc.

This standard is not applied for the works designed according to special requirement.

2. Normative references

TCVN 2103:1994 PVC insulated wire.

TCVN 4756:1986 Code of practice of ground connection and O's connection of electrical equipments.

TCVN 6612:2000 (IEC 228:1978) Conductor of insulated cables.

3. Terms and definition

3.1 Automatic fire alarm system: the system of automatic fire detection and fire place information.

3.1.1 Conventional fire alarm system: automatic fire alarm system without function of informing the address of each fire detector.

3.1.2 Addressable fire alarm system: automatic fire alarm system with function of informing the address of each fire detector.

3.1.3 Intelligent fire alarm system: Besides the conventional fire alarm function and addressable fire alarm function, automatic fire alarm system can measure some fire parameters at the area where fire detector is installed such as temperature, smoke concentration or/and automatically changing impact threshold of fire detector in accordance with requirement of designer and installer.

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3.2 Automatic fire detector: Automatic devices are sensitive to phenomenon accompanied with fire (temperature increasing, smoke spreading, light release) then transmit suitable signals to fire alarm control panel.

3.2.1 Heat detector: Automatic fire detector is sensitive to temperature increase of the place where the detector is installed.

3.2.1.1 Fixed temperature heat detector: Heat detector impacts when temperature at the position where was installed fire detector reach to the predetermined value.

3.2.1.2 Rate-of-rise heat detector: Heat detector impacts when temperature at the position where was installed fire detector has the increasing speed reaching the determined value.

3.2.1.3 Line-type heat detector: Heat detector has line-type or small-pipe structure.

3.2.2 Smoke detector: Automatic fire detector is sensitive to the impact of smoke created by rigid grain or liquid produced from burning process and/or the thermal decomposition process.

3.2.2.1 Ionization smoke detector: Smoke detector is sensitive to the products of burning process, which are able to impact on ionization current inside fire detector.

3.2.2.2 Photoelectric smoke detector: Smoke detector is sensitive to the products of burning process, which are able to impact on radiation or dispersion absorption in infrared area and/or ultraviolet area of electromagnetic spectrum.

3.2.2.3 Optical smoke detector: same as Item 3.2.2.2.

3.2.2.4 Projected beam-type smoke detector: Smoke detector consists of two parts that are projecting light ray end and receiving light ray end, shall impact when smoke appears at the middle of projecting end and receiving end.

3.2.3 Flame detector: Automatic fire detector is sensitive to radiation of flame.

3.2.4 Automatic Testing Function Detector – ATF: Fire detector has function of automatic control of its feature to transmit to Fire alarm control panel.

3.2.5 Combine detector: Automatic fire detector is sensitive to at least two phenomena associated with the fire.

3.3 Manual call point: the device allows the manual operation of initial fire alarm

3.4 Electrical power supply: the device supplies power for fire alarm system.

3.5 Conjunctive devices: Including spare parts, cable system and signal wires, parts making conjunctive line among devices of fire alarm system.

3.6 Fire alarm control panel: the device supplies power for automatic fire detectors and performs the following functions:

- Reception of signals from automatic fire detector and generation of the fire alarm signal, instructions of firing place.
- Transmission of fire alarm signal through signal transmission device to place of receiving fire information or/and to automatic fire fighting equipments.
- Inspection of normal working of system, break-down instructions of system such as wire rupture, short circuit...
- Automatic control of other peripheral equipments operation.

4. General requirements

4.1 Design, installation of automatic fire alarm system must comply with requirements and regulations of current related standards, codes and be approved by competent authorities of fire prevention and fighting

4.2 Automatic fire alarm system must meet following requirements:

- Detecting quickly fire according to proposed functions;
- Changing fire detecting signal into clear alarm signal for surrounding persons to be able to perform suitable methods immediately.
- Resisting well disturbance.
- Notifying quickly and clearly all accidents of the system.
- Not effected by other systems installed together or separately.
- Not be paralyzed partially or entirely by fire before fire detection.

4.3 Automatic fire alarm system must ensure reliability. The system must perform completely proposed functions but no mistake.

4.4 Outside impacts cause troubles for one part of system shall not cause next troubles in system.

4.5 Automatic fire alarm system including of basic parts:

- Fire alarm control panel;

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- Automatic fire detector;
- Manual call point;
- Conjunctive devices;
- Electrical power supply;

Depending on requirements of fire alarm system, there are other parts such as fire alarm signal transmission device, checking device of automatic fire prevention and fighting equipments.

5. Technical requirements for Fire Alarm Control Panel

5.1 Automatic fire alarm control panel must have function of automatic checking for the signal received from channels to eliminate false fire alarm signals. Allow using automatic fire alarm control panels without function of automatic signal check in case of using fire detectors with function of automatic signal check. Not allow using panels without fire alarm function for automatic fire alarm control panel.

5.2 Fire alarm control panel shall be set at places where there is a permanent person on duty for the whole day and night. In case of short of person on duty, fire alarm control panel must have function of fire signal transmission and its troubles to fire watch place or permanent person on duty and must have method to prevent non-duty person from contacting with fire alarm control panel.

Place setting fire alarm control panel must have telephone to contact directly to fire fighting team or place receiving fire alarm information.

5.3 Fire alarm control panel must be installed on the wall, partition, table at the un-dangerous place of fire and explosion

5.4 If fire alarm control panel is installed on building components made of inflammable materials, these components must be protected by metal sheet of 1mm and over width or by other non-flammable materials of the width not less than 10mm. In this case, protecting sheet must have a dimension so that its each side projects from the side of panel at least 100mm at every direction.

5.5 The distance between fire alarm control panels and the ceiling made of inflammable materials shall not be smaller than 1.0m.

5.6 In case installing side-by-side, the distance between fire alarm control panels shall not be smaller than 50mm.

5.7 If fire alarm control panel is installed on the wall, column or support, the distance from control part of fire alarm control panel to the floor shall be from 0.8m to 1.8m.

5.8 Temperature and humidity at fire alarm control panel must meet technical files and user manual of fire alarm control panel.

5.9 Sound signal of fire alarm and break-down alarm must be different.

5.10 When installing automatic fire detectors on fire alarm control panel, it must pay attention to conformity of system (supplying voltage for fire detector, kind of fire alarm signal, method of break-down detection, line checking part).

6. Technical requirements for automatic fire detector

6.1 Automatic fire detectors must ensure detecting fire according to designed functions and specifications in Table 1. Selection of automatic fire detector must base on properties of flammable substance, features of protecting environment and to characteristics of equipped units, refer to Annex A.

Table 1

Specification	Heat detector	Smoke detector	Flame detector
Impact time	Not more than 120 seconds	Not more than 30 seconds	Not more than 5 seconds
Impact threshold	From 40 ⁰ C to 170 ⁰ C Temperature increase is over 5 ⁰ C/minute	Opaque level caused by smoke*: From 5 to 20%/m for conventional smoke detector From 20 to 70% on distance between projecting end and receiving end of projected beam-type smoke detector	Open flame of 15mm height, 3m apart from fire detector
Atmospheric humidity at place setting fire detector	Not more than 98%	Not more than 98%	Not more than 98%
Working temperature	From -10 ⁰ C to 170 ⁰ C	From -10 ⁰ C to +50 ⁰ C	From -10 ⁰ C to +50 ⁰ C
Protecting area	From 15m ² to 50m ²	More than 50m ² to 100m ² **	Pyramid with angle

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			120 ⁰ , height from 3m to 7m.
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Note:

* Impact threshold of smoke detector is counted by opaque level caused by smoke per a given distance.

** Protecting area of projected beam-type smoke detector is area limited by distance between projecting end and receiving end (from 5 to 100m) and width at two sides along to projecting ray (15m): from 75 to 1500m².

6.2 Fire detector must have indicating lamp once impacting. When automatic fire detector has not indicating lamp, the support of automatic fire detector must have substitute alarm lamp.

For wireless fire detector (radio fire detector and site fire detector), except for indicating lamp when impacted, its must have a lamp indicating the state of power supply.

6.3 Number of automatic fire detector to be installed in a protecting area depends on the necessity level to detect fire on the whole area of that area and must ensure economic, technical requirement.

If automatic fire alarm system is used for controlling automatic fire fighting system, each point in protecting area must be controlled by two automatic fire detectors of two different channels.

In case the house has suspending ceiling with technical systems, electric cables, signal cables installed between ceiling layers, it must further install fire detector on the upper ceiling.

6.4 Smoke detectors and heat detectors shall be installed on the ceiling or roof. If the installation on ceiling or roof is impossible, allow installing on the beam and column or hanging by wire under the ceiling in the condition that fire detectors must be apart less than 0.3m from the ceiling including size of automatic fire detector.

6.5 Smoke detectors and heat detectors must be installed in each compartment of the ceiling limited by members protruding down (girder, beam, panel side) more than 0.4m.

In case the ceiling with protruding down parts from 0.08m to 0.4m, installation of automatic fire detector is regarded as the ceiling without above protruding parts but the protecting area of an automatic fire detector shall be decreased by 25%.

In case protruding down parts pass over 0.4m and width over 0.75m, it must further install fire detector at those protruding parts.

6.6 In case material heap, supports, equipments and building components have highest point apart smaller or equal to 0.6m from the ceiling, automatic fire detector must be installed right above those positions.

6.7 Number of automatic fire detectors hang on one channel of fire alarm system depends on technical characteristics of fire alarm control panel but protecting area of each channel shall not be more than 2000m² for open protecting area and 500m² for closed area. Automatic fire detectors must be used according to their technical requirements, standards and technical files taking into account environment condition of protected place.

Note:

Open protecting area is the place where if fire happens, smoke, firelight shall be seen such as stores, producing workshop, meeting-hall...

Closed protecting area is the place where if fire happens, smoke, firelight shall not be seen such as cable trench, suspended ceiling, closed rooms...

6.8 In case fire alarm control panel without address indicating function of each automatic fire detector, automatic fire detectors hang on one channel shall allow control up to 20 rooms or areas on the same floor with shared corridor exit but outside of each room must have lamp indicating the fire impact of any fire detector installed in those rooms, simultaneously must ensure requirement of article 6.7.

In case rooms have glass door or glass wall with shared corridor from that the room inside can be seen through the glass wall or glass door, allow to not installing indicating lamp in that room.

6.9 The distance from fire detector to outside edge of blowing orifice of ventilation system or conditioner system shall not be smaller than 0.5m.

Not allow to lay fire detector directly in front of the above blowing orifice.

6.10 In case where a protecting area is installed with many kinds of fire detectors, the distance between detectors must ensure so that each position in that area is protected by at least one detector.

When a protecting area is equipped with combine detector, the distance between detectors shall be specified according to property of main inflammable substance of that area.

6.11 For protecting area with explosion hazard, it must use fire detector resistant to explosion.

In the area with high humidity and/or a lot of dust, it must use fire detector resistant to humidity and/or dust.

In the area with many insects, use fire detector competent to prevent insects from penetration into fire detector or there must be any method preventing insects from penetration into fire detector.

6.12 Smoke detector

6.12.1 Protecting area of one smoke detector, maximum distance between smoke detectors and between smoke detector and wall must be specified according to Table 2, but not be more than values given in technical requirement and technical files of smoke detector.

Table 2

Height of installing fire detector, m	Protecting area of one fire detector, m ²	Maximum distance, m	
		Between detectors	From fire detector to the wall
Below 3.5	smaller than 100	10	5.0
From 3.5 to 6	smaller than 80	8.5	4.0
More than 6.0 to 10	smaller than 65	8.0	4.0
More than 10 to 12	smaller than 55	7.5	3.5

6.12.2 In rooms with width below 3m, allowable distance between smoke detectors is 15m.

6.12.3 Ionization smoke detector shall not be installed at the places with maximum wind speed greater than 10m/s.

6.12.4 Optical smoke detector shall not be installed at the places where inflammable substances, if burned, mainly cause black smoke.

6.12.5 For projected beam-type smoke detector, distance between straight line connecting the projecting end and receiving end of two pairs shall not be greater than 14m and distance to the wall or other fire detector shall not be over 7m. Between projecting end and receiving end of projected beam-type smoke detector, any object obstructing projected ray shall be not allowable.

6.13 Heat detector

6.13.1 Protecting area of a heat detector, maximum distance between heat detectors and between heat detector and the wall shall be determined according to Table 3 but shall not be greater than the values given in technical requirements and technical files of heat detector.

Table 3

Height of installing fire detector, m	Protecting area of a fire detector, m ²	Maximum distance, m	
		Between detectors	From fire detector to the wall
Below 3.5	smaller than 50	7.0	3.5
From 3.5 to 6	smaller than 25	5.0	2.5
Greater than 6.0 to 9.0	smaller than 20	4.5	2.0

6.13.2 Impact threshold of heat detector must be greater 20⁰C than maximum allowable temperature in the room.

6.14 Flame detector

6.14.1 Flame detectors in the rooms or area must be installed on the ceiling, the wall and other building components or directly on equipment to be protected.

6.14.2 Designing and laying flame detector must ensure so that protected area shall meet the condition given in Table 1 and the values in technical conditions and technical files of flame detector.

7. Technical requirements for Manual call point

7.1 Manual call point is installed inside and outside of the house and the building, on the wall and members at the height 0.8m to 1.5m above floor or ground surface.

7.2 Manual call point must be installed on emergency exits, on rest step of stair at the easy view position. If necessary, it can be installed in each room. The distance between manual call points shall be not over 50m.

7.3 If manual call point is installed outside of the building, the maximum distance between manual call points shall be 150m and have clear notation. Manual call point installed outside the building must be waterproof or have method preventing the rain penetration. The place setting manual call point must be continuously illuminated.

7.4 Manual call points can be installed according to particular channel of fire alarm control panel or shared on one channel with fire detectors.

8. Technical requirements for conjunctive devices

8.1 Selection of conducting wires and cables for circuits of automatic fire alarm system shall be in accordance with TCVN 2103:1994 and TCVN 5397:1991, technical requirement of this standard and technical documents of specified equipment.

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8.2 Signal cable of automatic fire alarm system must be immersed in the wall and ceiling... and must have a method protecting short circuit or wire rupture (pass through metal pipe or other protecting pipe). In case of open layout, it must have method preventing from mouse bite or other mechanical reasons damaging cable. The holes in ceiling and wall must be covered by non-flammable material after finish the work.

8.3 Signal circuits of automatic fire alarm system must be checked automatically about technical situation along the whole length of signal circuit.

8.4 Fire alarm signal circuits must use independent conductors and copper core cables. Allow to use communication cable with copper core of combined communication network in condition that communication channel must be separated.

8.5 Copper core of each signal conductive wire from automatic fire detectors to trunk cable line must be not smaller than 0.75mm^2 (equivalent to copper core with diameter of 1mm). Allow using multiple twisted conductors but total section area of these twisted copper conductors shall not be smaller than 0.75mm^2 . The section area of each copper core in the trunk cable shall not be less than 0.4mm^2 . Allow using multiple conductor cable in a same protection cover but copper core diameter of each conductor shall not be smaller than 0.4mm.

Total resistance of each communication channel of fire alarm shall not be greater than 100Ω but shall not greater than required value for each kind of fire alarm control panel.

8.6 Control cables of peripheral equipment, signal conductors connecting fire detectors in automatic fire fighting system shall be highly heat-resistant (fire-proof cables). Allow using peripheral equipment controlling cables by conventional cables but it must have method preventing from heat impact at least within 30 minutes.

8.7 Not allow to install electrical circuit of automatic fire alarm system together with voltage circuit over 60V in the same pipeline, box, bunch and the closed slot of building component.

Allow to install the above circuits when between them exist a longitudinal partition made of flame resistant materials with fire-resistant limit not below 15minutes.

8.8 In case of uncovered parallel connection, the distance between conductors of lighting line and motive force with cable of fire alarm system shall not be smaller than 0.5m. If this distance is smaller than 0.5m, it must have method of electromagnetic interference resistance.

8.9 If there is an interference source in the work or for addressable fire alarm system, it is imperative to use interference resistant conductors and cables. If using interference unresistant conductors and cables, it is imperative to put them in earthing metal pipe or box.

For conventional fire alarm system, recommend to use interference resistant or unresistant conductors and cables but it must put them in earthing metal pipe or box.

8.10 Number of connectors of terminal box and number of conductors of the trunk cable must have a backup of 20%.

9. Technical requirements for power supply and earthing

9.1 Center of fire alarm system shall be equipped with two independent power supplies. One is 220V AC supply and other is reserve battery.

Variation value of potential of AC supply for fire alarm control panel shall not be over $\pm 10\%$. When this value exceeds 10%, use voltage stabilizer for supplying the fire alarm control panel.

Capacity of reserve battery must ensure at least 12 hours for equipment operation at permanent mode and one hour when occurring fire.

9.2 Fire alarm control panel must be earthed. Earthing shall meet requirements of TCVN 4756:1989.

10. Inspection for acceptance, storage, maintenance

10.1 Equipments of fire alarm system must be tested about quality, categories before installing.

After installed, automatic fire alarm system must be tested, accepted by competent authorities before put into operation.

10.2 After putting into operation, automatic fire alarm system must be checked at least one time every year. While checking, all of functions of system must be tested and all of fire alarm equipments must be tested for operation. Any damage must be repaired immediately.

Depending on environment condition at the place installing fire alarm system, but at least one time each two year it must carry out maintenance of the whole system. When performing maintenance, it must check sensitivity of all fire detectors. The fire detector not meeting requirement of sensitivity must be replaced.

Annex A

(Reference)

Selection of automatic heat detector according to characteristics of the equipped units

No.	Fire detector	Feature of equipped unit
A. Production unit		
I. Production and storage unit		
1a	Heat detector or optical smoke detector	Wood and wood products, textile products, ready-made clothes, leather shoes, feather products, tobacco, paper, cellulose, cotton.
1b	Heat detector or ionization smoke detector	Synthetic plastics, synthetic fibre, polymer material, rubber, rubber product, man-made rubber, flammable films and X-ray films.
2	Heat detector or flame detector	- Liquid oil, paint, solvent, flammable liquid, lubricant, strongly active chemical substance, alcohol and alcohol products.
3	Flame detector	- Alkali metal, metal powder, natural rubber
4	Heat detector	- Cereals powder, synthetic food and other food, dust spreading materials.
II. Production unit		
5	Heat detector or flame detector	Paper, carton sheet, cardboard, poultry and animal feeds
III. Storage unit		
6	Heat detector or smoke detector	- Non-flammable material contained in package made of flammable materials, flammable solids.
B. Specialized works		
7	Heat detector of ionization smoke detector	- Cable room, transformer room, distribution apparatus and electric board.
8	Ionization smoke detector	- Computer room, electronic control equipments, control machine, automatic telephone station, broadcasting cabin, terminal, commutator rooms

9	Heat detector or flame detector	- Room for equipments and pipes of flammable liquid, lubricating oil, rooms for testing internal combustion engine, room for testing fuel machine, room for charging flammable air.
10	Heat detector or ionization smoke detector	- Car maintenance workshop
C. Houses and public works		
11	Photoelectric smoke detector	- Performing room, exercising room, lecture hall, reading-room and seminar room, room for actor/actress, make-up room, clothes room, repairing place, waiting room, greenroom, corridor, anteroom, book preservation room, archives room.
12	Heat detector or photoelectric smoke detector	- Props store, administrative room, machine room, control room.
13	Heat detector	- Accommodation room, patient room, warehouse, public restaurant, kitchen.
14	Photoelectric smoke detector or flame detector	- Showroom, room for archived objects of museum, exhibition.
		Note – In a room where there are multiple different fire sign at the initial stage, when installing automatic fire detector it need to determine according to economic and technical condition.