Aspirating system

TITANUS®

aspirating smoke detection

contents

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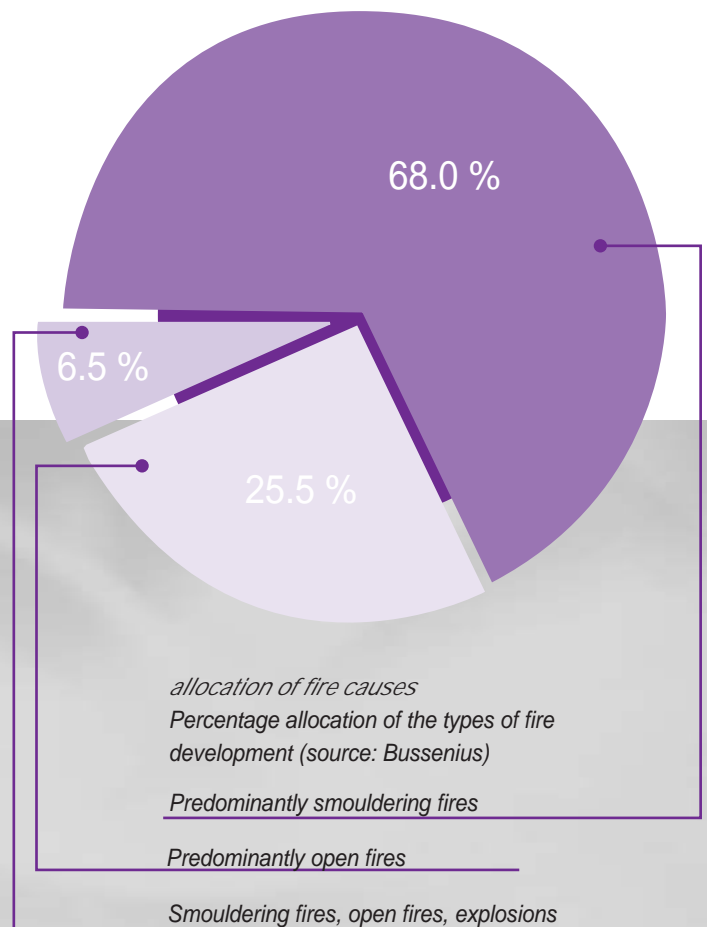æ aguilera GRUPO

Aspirating smoke detection systems

High organisational centralisation, consolidated production and storage, large commodity flows - merely all measures which lead to high productivity are linked with the concentration of decisive values at companies and at the public sector.

With it, the responsibility for fire protection increases. The higher the value of the asset is to the business, the more devastating a fire can be to Business continuity and its survival. The higher the concentration of people, the higher the hazard is to their safety.

Aspirating smoke detection systems provide earliest fire protection at a very high level of immunity to false alarms.

the reliable fire characteristic: smoke

Three characteristics make a fire identifiable: smoke, heat and light. Fire statistics clearly show that the vast majority of the hostile fires are initiated via extensive smouldering fire phases. In these cases highly-sensitive smoke detection ensures a fast response and minimises fire loss and business disruption.

68.0 %

6.5 %

25.5 %

allocation of fire causes
Percentage allocation of the types of fire development (source: Bussenius)

Predominantly smouldering fires

Predominantly open fires

Smouldering fires, open fires, explosions

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The main components of aspirating smoke detection systems:
1 *Pipes system with air sampling points*
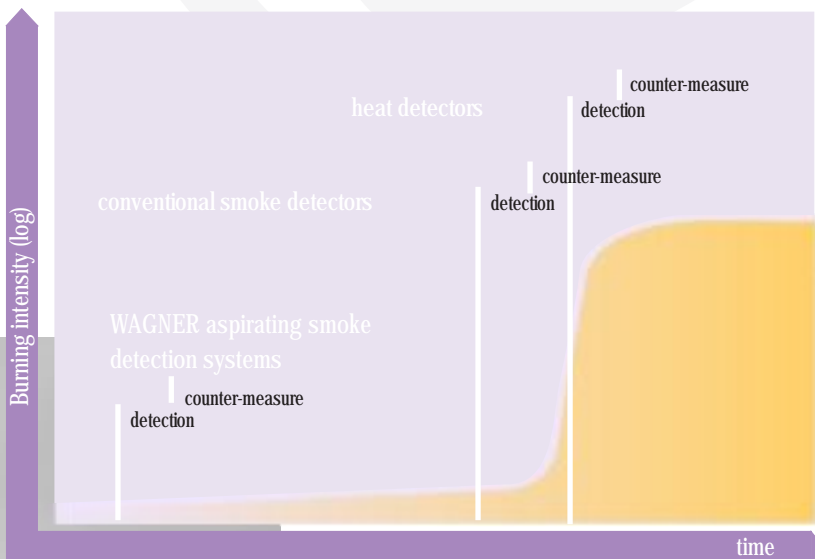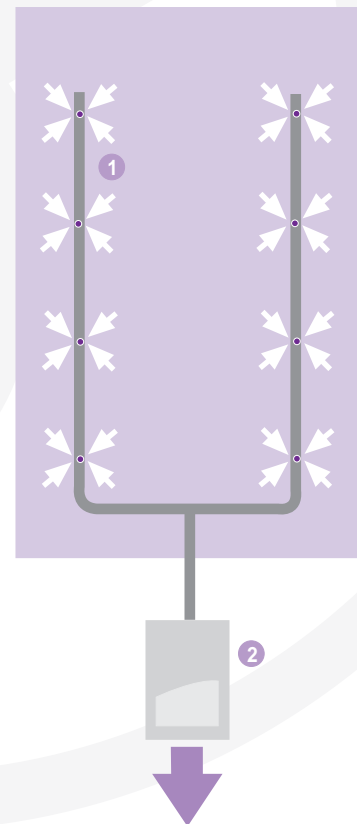2 *Aspirating smoke detection device*

main components and functional principle

WAGNER aspirating smoke detection systems act on a simple functional principle and are constructed on a highly-modular basis. Thus, they can be designed individually and ideally adapted to environmental conditions and potential hazardous situations. They consist of two main components: the air sampling pipes in the monitoring area and a smoke detection device which can be separated spatially from the monitoring area.

A ventilator integrated in the smoke detection device produces negative pressure in the air sampling pipes and continuously takes air samples at defined air sampling points. These are checked for smoke particles in the measuring chamber. To help eliminate false alarms, intelligent signal processing analyses the measured data and compares it against typical fire characteristic patterns.
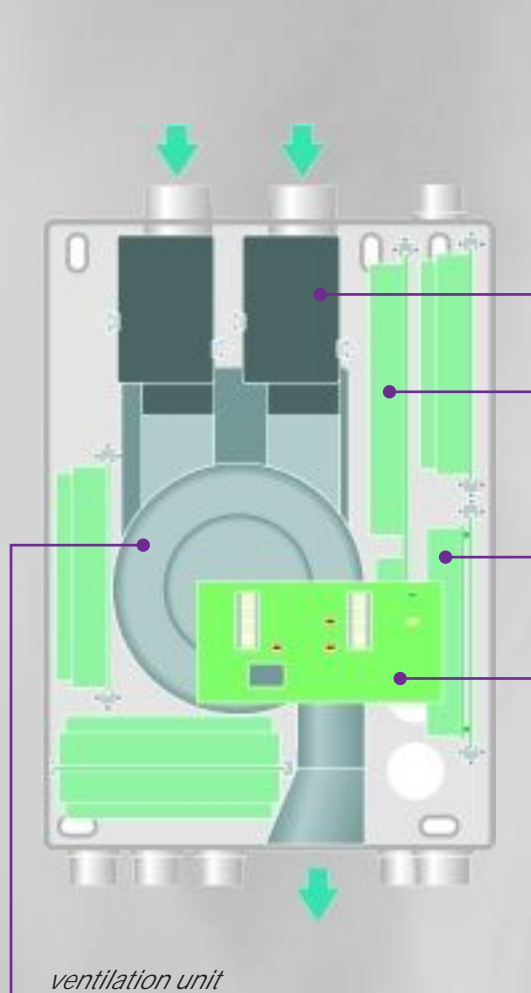

Fire detection systems in comparison
WAGNER aspirating smoke detection systems provide a decisive advantage in time compared to conventional smoke and heat detectors..

Highly modular construction: the aspirating smoke detection device

With five different basic devices and numerous configurations and equipment options, the family of TITANUS® aspirating smoke detection devices cover the whole spectrum of applications in smoke detection. Due to its highly-modular design it can be easily adapted to the required monitoring task.
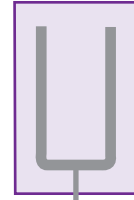
detector module(s)

In the detector module the aspirated air is checked for its light obscuration. The high-power light source (> HPLS) technology used is highly sensitive and is far more advanced than conventional technologies. The detector modules are installed and dismantled without tools and easily configured via DIL switches. Depending on the application, the equipment with two detector modules can be used for the monitoring of a second area or for a dual detector-dependency.

main board/mother board

Here, the measured values delivered by the detection unit are evaluated continuously. Different, type-dependent routines are installed to prevent false alarms (> LOGIC•SENS), to monitor the pipe system for clogging (PIPE•GUARD) and to locate the smoke source within the monitored area (> ROOM•IDENT). The available alarms can be connected to a fire control panel via volt-free contacts or via data bus.
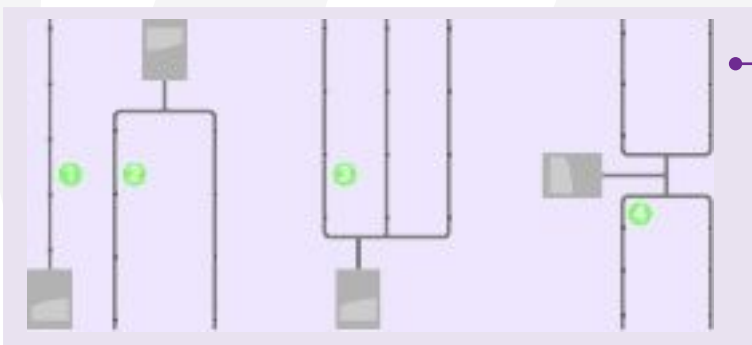
mounting slot

Numerous free mounting slots provide the option of subsequent upgrading of TITANUS® aspirating smoke detection systems with optional circuit boards (e.g. network, isolation or bus interface).

ventilation unit

For the aspiration of air samples via the pipe system, the ventilator produces a constant negative pressure.

display circuit board

The operating conditions are displayed by LEDs on the front of the housing. Type-dependent, the level of the current smoke density is visualised via a bar graph. Additionally, operating conditions and smoke density can be displayed via remote display units.
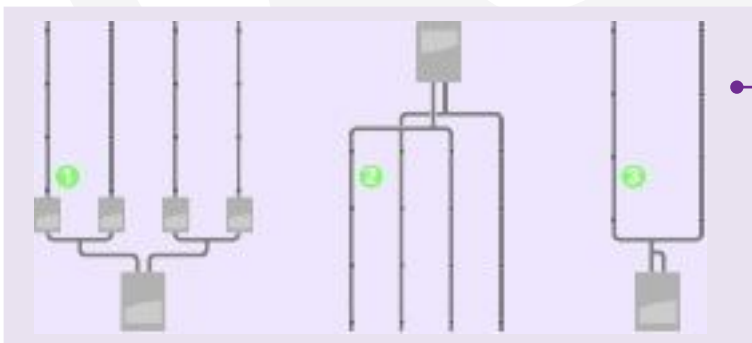
accessories

A comprehensive range of accessories also in sophisticated areas, in which other solutions fail, provides for a safe detection.

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Easy to install:
the pipe system

WAGNER focuses on the quickest possible and simplest instrument for the projecting of pipe systems, the so-called "pre-engineered piping". The pipe system is easy to design and install, with a range of pre-fabricated fittings and software to assist the design. All pipe components are available in PVC as well as in non halogen versions.

schematic installation diagrams for the use of detector modules (examples)

1 Installation of I-pipes
2 Installation of U-pipes
3 Installation of M-pipes
4 Installation of double U-pipes

schematic diagrams of installation for the implementation of a dual-detector dependency (examples)

1 Room protection with detector boxes
2 Room protection
3 Equipment and small rooms monitoring

air sampling points

A balanced distribution of the detection over all aspirating points is ensured and annoying whistling is avoided by means of graduated aspiration film sheets (illustration at scale 1:1).

accessories (selection)

- *aspiration clip for deep freeze areas*
- *manual and automatic blow-through Systems against icing and dust deposit*
- *in-line detonation flame arrester for explosion hazardous areas*
- *filter, special filter for extremely dusty areas*
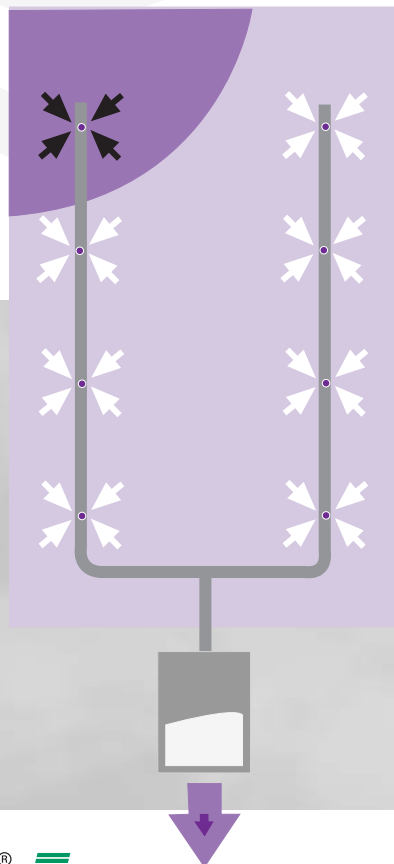- *steam trap*

Installed dynamics:
the response behaviour

When a specified smoke density value or smoke density rise is exceeded, conventional, point-type smoke detectors trigger an alarm. No alarm is given below these limits, even if several single detectors are applied with smoke.

Aspirating smoke detection systems, however, possess the so-called collective effect. This effect occurs if several air sampling points are in a room and at the same time are exposed to smoke from the fire. For this reason the response sensitivity of an aspirating system has many advantages.
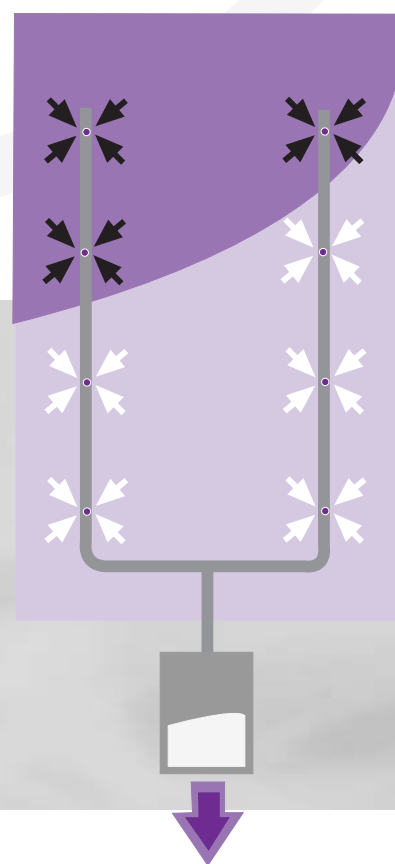
The power of the collective effect is relative to the size of the monitoring area and the height of a room. In rooms with high ceilings a collective effect of up to 50 % can be assumed. That means that at least half of all air sampling points are typically exposed to smoke.

Even without this collective effect, aspirating smoke detection devices, however, already constitute an abundantly equal alternative to point-type smoke detectors. Highly developed detection units thereby permit an up to 5,000 times higher sensitivity than point-type detectors.

Response sensitivity without collective effect

Response sensitivity with collective effect
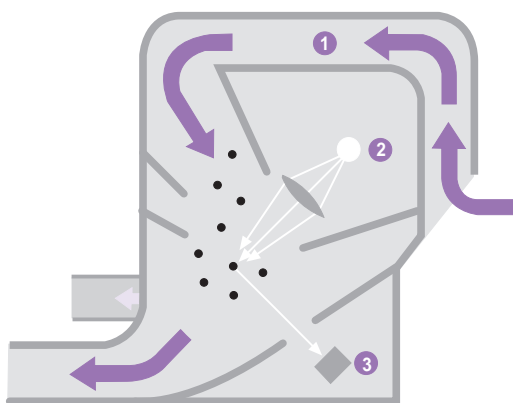
Specific performance features

Beyond the system-related benefits of aspirating smoke detection systems, WAGNER offers unique performance features for highest operational reliability and variability as well as easy handling during installation and in operation.

>> plug & play

The plug & play function permits easy and quick commissioning of the TITANUS® aspirating smoke detection systems. Depending on the type of device, all standard functions are preprogrammed or preadjusted via DIL switches. Neither software nor a programming tool are necessary.

>> Extreme high sensitivity by HPLS

By means of the high-power light source (HPLS), the sensitivity of the detector modules is up to 5,000 times higher than conventional smoke detectors and ensures homogeneous response behaviour at different types of fire. As compared to conventional aspirating smoke detection systems, the main air flow is not just lead over a point-type detector but through a measuring chamber which is specially developed against the deposit of dust particles.
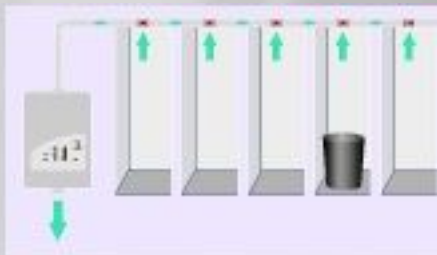
high-power light source

1 controlled air flow against deposits
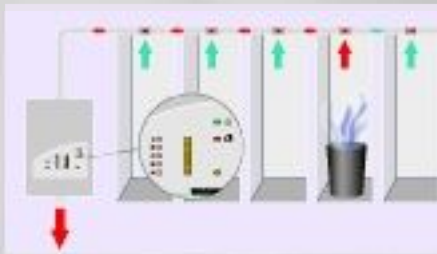2 light source (emitter/transmitter)
3 photodiode (receiver)

ROOM·IDENT makes sure that fires not only can be detected at an early stage but also their location identified. With only one detection unit up to five rooms can be monitored. In four phases ROOM·IDENT identifies where the seat of the fire is located. The system can be divided into zones, much like a conventional addressable system, with front panel LEDs indicating in which zone the fire is located.

Phase 1 (normal operation)

During normal operation air samples are taken from the pipe system reaching into different rooms, and checked.

Phase 2 (very early smoke detection)

Developing smoke is taken in and detected. Alarm takes place and thus allows early intervention.

Phase 3 (blow-through)

Once the alarm has been activated, the air sampling ventilator turns off and a second ventilator turns on to push the smoke particles out of the pipe system.

Phase 4 (identification)

After the pipe system has been blown through, the flow direction is reversed again. By measuring the time delay for the smoke to reach the detector module, the fire can be allocated to a specific monitoring point.

Alternatively, ROOM·IDENT can be adjusted in such a way that the identification already starts at the activation of a pre-alarm. Independent from the main alarm threshold, the pre-alarm threshold is adjustable.

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>> prevention against false alarm by LOGIC·SENS

The intelligent signal processing LOGIC·SENS checks the incoming signals against established algorithms which are based on numerous fire tests and decades of experience. False alarm factors, such as dust, exhaust gases and humidity are even suppressed in extreme areas to a large extent by comparison with typical fire characteristic patterns.

example for the signal path of the air flow sensor at failures

>> Check of the pipe system by PIPE•GUARD

Our air flow monitoring system PIPE•GUARD is permanently checking the pipe system for fracture or clogging. The sensitivity is adjustable up to monitoring a single hole. The air flow monitoring is temperature-compensated and can be adjusted dependent on the air pressure.

WAGNER aspirating smoke detection system

> Very early smoke detection by high sensitivity

> High immunity to false alarms, even under difficult ambient conditions

> Easy system design and installation

> Easily accessible for maintenance and service

> Accurate detection of single blocked air sampling points possible to indicate sabotage of the pipe system

WAGNER aspirating smoke detection systems: Applications

For the very early smoke detection

- for example in EDP and telecommunications areas, semiconductor industry

Minimisation of business interruption by earliest possible smoke detection; up to 5,000 times as sensitive as compared to conventional, point-type smoke detectors.

At poor accessibility

- for example in high-rack storage areas, inside courtyards and high rooms

Quick and easy inspection of the fire detection technology by installation of the detection unit at an accessible height.

In ad-joining rooms

- for example in hotel rooms, ship cabins, compartments, prison cells

Inexpensive monitoring of up to five adjoining rooms with fire localisation.

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In dusty environments

- for example in recycling facilities, tunnels and in the paper industry

Reliable protection against false alarms by the combination of a robust technology with application-compatible accessories such as special filters and a blow-through system.

In aesthetically pleasing buildings

- for example in libraries, modern and historical architecture

Virtually invisible fire detection technology by hidden installation of air sampling pipes and air sampling points.

In safety areas

- for example in prison cells, vaults, armouries

Safety-relevant areas do not have to be entered for inspections and servicing.

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Under icy
and frosty conditions

**- for example in deep freeze storage areas
and unheated storage areas**

Very early smoke detection at as low as -40 °C by innovative high-power light source (HPLS) technology as well as special deep freeze devices and accessories.

When technology must
always be available

- for example in control cabinets, production facilities and server rooms

Best possible guarantee of the availability of neuralgic production and Communications facilities by very early smoke detection and automatic power shut-off.

In constricted areas

- for example in cable ducts, voids and false floors

Optimum fire protection in areas which provide insufficient space for the installation of conventional fire detection technology.

In stand-alone applications

- for example in wind power plants and accessible transformer units

Inexpensive monitoring of small rooms with the option of remote diagnostics, in particular for decentralised installations located far away.

In the area of strong electromagnetic fields

- for example in high-voltage switchgears and transformer units

Fire detection without being influenced by electromagnetic fields or nuclear radiation by the installation of the detection unit outsider of the monitoring area.

At high condensing humidity areas

- for example in saunas, cold storage rooms, unheated storage areas

Insensitivity against condensing humidity by the use of a steam trap before the detection unit.

Project design according to EN 54-20: What has changed?

EN 54-2 0 – a requirement for the CE mark

The product standard EN 54-20 for air sampling smoke detection systems (ASD) was introduced in 2007. Since July 2009, the transition period of this harmonised EU standard has expired. National standards and guidelines which were in conflict with EN 54-20 had to be withdrawn until this point of time. As air sampling smoke detection systems and other fire detectors are subjected to the Building Products Guideline, the compliance with EN 54-20 is precondition for the CE marking. This means: Anybody bringing an ASD on the market after June 2009 that is not approved according to EN 54-20 (including the project design), will loose the permission to bear the CE mark.

For the first time transparency in the matter of sensitivity

Anybody specifying a protection goal for an application area needs a fire detector with a defined sensitivity. That was the problem up to now, because reliable information concerning sensitivity were missing.

In the past, the manufacturer could define the nominal sensitivity of his device arbitrarily (a comparability of this information was not given). With EN 54-20, a classification for smoke detectors concerning their suitability for very early fire detection has been introduced for the first time.

Via downscaling the test fires for point-type smoke detectors by up to factor 40, fire scenarios for three different kinds of classes have been generated (see table 1).

Legal certainty for the use of accessories

As from now, accessories have to be tested by an accredited testing body. Furthermore, they have to be listed in the certificate of approval (e.g. VdS), unless it can be estimated via a simple inspection that the used accessory does not have any influence on the sensitivity of the system and/or its aspiration.

This innovation applies for every Project design and installation of air sampling smoke detection systems in the EU.

The use of an untested filter e. g. automatically means the loss of CE conformity. Therefore, in case of doubt, the project design should include from the beginning the possibility of upgrading or retrofitting the ASD with appropriate accessories (e.g. filters).

	Sensitivity	Application Area
Class A	Very high	Earliest possible fire detection, above all for areas with a high level of air dilution and air-condition
Class B	Enhanced	Very early fire detection for the majority of areas, where goods of high value and/or processes shall be saved
Class C	Standard	Fire detection for areas, where point-type detectors (e.g. for maintenance or aesthetics) are not sufficient

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VDE 0833 - 2: At least class B for high - ceilings

With VDE-0833-2 German regulation started to consider the sensitivity classes A to C according to EN 54-20. Depending on the ceiling height appropriate sensitivity classes have to be fulfilled (see table 2). Similar considerations of taking into account the dilutive effect within high rooms are ongoing in several member states of the EU.

Immunity to false alarms and maintaining the protection goal

In areas where various interfering factors have to be expected, there are two basic means that have been established to avoid false alarms by smoke detectors (beside the use of physical filters):

- **Suppression of fault scenarios via smoke pattern recognition**

  The sensitivity / the protection goal keeps on being maintained

- **Decrease of sensitivity by means of parameterization or self-learning algorithms:**

  The sensitivity / the protection goal is decreased

With the EN 54-20 and its classification, stringent rules apply for the decrease of the sensitivity now: below a determined limit, a detector automatically complies only with a lower class and, therefore, it misses the predetermined protection goal.

In consequence even the loss of CE conformity is possible. As the legal consequences of elevated desensitizing are dramatically in case of fire, the EN 54-20 serves for a high degree of customer protection. Actually, the required detection quality now must be maintained also during operation.

Height up to 12 m	Class A, B or C
Height from 12 m up to 16 m	Class A or B
Height from 16 m up to 20 m	Class A (if the efficiency of the detection is proven)

VDE 0833-2, as per 06/09

Limits in project design instead of transport time limits

EN 54-20 takes into consideration the project design of air sampling smoke detection systems: Special test fires have to be detected within a certain period of time in order to comply with the standard and its classifications.

This goal can be achieved via high sensitivity and comparably long (smoke) transport time as well as via less sensitivity and comparably short transport time. For this reason, the influence of the transport time can no longer be separated from the sensitivity of an air sampling smoke detection system. Consequently, the transport time limits as during the validity of the guideline CEA 4022 do not exist any more. Instead of this, testing bodies now specify limits for project design. These limits are derived from the design of the test set-up which has been proved to detect the standardized test fires.

The resulting design limits are given in the technical manual and/or in the project design software of an ASD (depending on the manufacturer).

cost reduction

monitoring capability

What is important for project design?

Not the classification of the detector but the classification of the project design is essential.

If an ASD device is labelled class A or B this does not necessarily mean that also the ASD project design complies with these classes. The labelling only shows that at least a minimum project design with one aspiration hole complies with the standard.
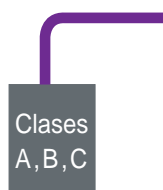
For this reason it is important to check if the planned project design meets the requirements of the desired sensitivity class in each and every point (no. of aspiration holes, pipe length, shape of pipe, accessories) (see figure 1).

Monitoring capability

The monitoring capability of an ASD is determined by the number of point-type smoke detectors which it is able to replace. This is the decisive factor for the cost effectiveness of any air sampling smoke detection system. The monitoring capability can easily be derived by the number of aspiration holes which can be realised at a realistic distance to each other (usually about 8 m).

A high number of aspiration holes or a long pipe work taken separately does not mean any considerable advantage on the market.

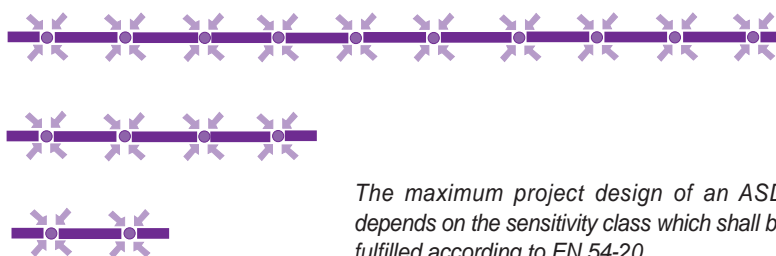Air sampling smoke detector

Clases A, B, C

Pipe work with aspiration holes

Class C

Class B

Class A

The maximum project design of an ASD depends on the sensitivity class which shall be fulfilled according to EN 54-20.

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product selection

The TITANUS® family from WAGNER typically offers a more cost-effective solution than other aspirating smoke detection systems. The customer only purchases as much technology as he actually needs. This applies both for the sensitivity of the systems and for further performance features.

The easy selection of a WAGNER aspirating smoke detection system is described in the following four steps.

1. Assorting of the requirements

Number of smoke aspirating points and pipe length

The required number of air aspirating points can be defined via the size of the monitored area as well as in compliance with the corresponding national standards and guide - lines for the planning of smoke detectors. The monitoring area corresponds to that of a conventional optical detector.

Already at this point, the required length of the air sampling pipe should be determined as this presents a limiting factor for the selection of air sampling smoke detection systems.

Specific requirements of the application

For the later selection of any accessories, any specific requirements need to be noted: dust exposure, condensing humidity, network compatibility, alarm organisation, visualisation of the data, etc.

Definition of the sensitivity

Three sensitivity classes for aspirating smoke detection systems have been defined within the scope of EN 54-20.

The classes A, B and C are suitable for the objective classification of sensitivity requirements and can be taken for almost all application areas.

Excepted from this are special areas such as clean rooms and IT sectors with high air change rate, where a sensitivity still higher as required in class A is should be taken.

Please find an overview of the sensitivity classes A, B and C including their application areas in chapter "Project design according to EN 54-20".

2. Selection of the aspirating smoke detection device

For the construction of a fire detection system with WAGNER aspirating smoke detection systems using the TITANUS PRO·SENS® and/or TITANUS TOP·SENS®, the standard module with 0.5 % light obscuration/m is sufficient. Dependent on the protection objectives, for example for the implementation of a very early smoke detection, however, a higher sensitivity can be reasonable.

3. Selection of accessories

After establishing any specific requirements the appropriate accessories can be selected (e.g. filter(s) in the event of dusty environments, steam trap(s) in the event of condensing humidity).

4. Selection of pipe and pipe accessory components

Planning of the pipe system

The required pipe components (air sampling pipe, arcs, end caps, ...) and the special accessories (aspiration-reducing film sheets, air filters,...) are to be determined. Due to the low flow resistance, bends are to be preferred to elbows.

Selecting the pipe material

The air sampling pipe can be made both of PVC and ABS. For the use at low temperatures and/or when a non-halogen air sampling pipe is required, the ABS material must be selected.

The following tabular data can be used to select the correct system to protect the facilities and for small rooms monitoring.

device-typical applications

TITANUS MICRO · *SENS* ®

The inexpensive aspirating smoke detection device for the protection of facilities and for the monitoring of small rooms.

- electrical and electronic facilities
- small to medium areas
- up to five areas with fire localisation

TITANUS PRO · *SENS* ®

The universally applicable TITANUS PRO·SENS® is the most frequently used TITANUS® aspirating smoke detection device world-wide. By utilising two detector modules, the area to be monitored can be doubled cost-effectively.

- EDP and telecommunications
- saunas
- air-conditioned rooms with high air change rates
- storage areas, high-rack storage areas, deep freeze storage areas
- production facilities
- recycling depots

TITANUS TOP · *SENS* ®

The advanced, universally applicable air sampling smoke detection device with smoke level indication and staged alarm (3 alarm thresholds). Can be equipped with 2 detector units.

TITANUS SUPER · *SENS* ®

The highly-sensitive device for special applications.

- clean rooms
- semiconductor fabrication
- EDP and telecommunications
- air-conditioned rooms with high air change rates

TITANUS RACK · *SENS* ®

Recommended aspirating system for the 19-inch racks protection

- EDP, server and telecommunication facilities
- control cabinets and emergency power facilities
- low and mean voltage distribution devices

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Display sensitivities of the different detector types

Column headers (diagonal labels):
- Number of detector modules
- Alarm threshold per module
- Bar graph
- Temperature range (ºC)
- Temperature range deep freeze version (°C)
- Dual-detector dependency
- Network compatible
- Max. length of pipe system (m)
- Max. number of aspirating points
- Classes according to EN 54-20

Detector types (light obscuration % / m)	Number of detector modules	Alarm threshold per module	Bar graph	Temperature range (ºC)	Temperature range deep freeze version (°C)	Dual-detector dependency	Network compatible	Max. length of pipe system (m)	Max. number of aspirating points	Classes according to EN 54-20
AETM-10xx** 0,01 ... 2,0 ; AETM-50xx** 0,05 ... 2,0	1	1-2	opt	-20 a +60	-40 a +40	pos.*	opt	50	8	A-C
AETPx-01 0,015 ... 0,12 ; AETPx-10xx 0,1 ... 0,8 ; AETPx-50xx 0,5 ... 1,0	1-2	1-3	no	-20 a +60	-40 a +60	pos.	opt	2x280	2x32	A-C
AETT-01xx 0,0015 ... 0,12 ; AETT-10xx 0,01 ... 0,8 ; AETT-50xx 0,05 ... 1,0	1-2	3	si	-20 a +60	-40 a +60	pos.	opt	2x280	2x32	A-C
AETSxx 0,0025 ... 0,2	1	3	si	-20 a +60	–	no	pos*.	200	24	A-C
AETR1-10x AETR2-10x 0,01 ... 2,0 ; AETR1-50x AETR2-50x 0,05 ... 2,0	1-2	2	opt	0 a +40	–	pos.	opt	39	10	A-C

Light obscuration (% / m): 0,01 | 0,02 | 0,05 | 0,1 | 0,2 | 0,4 | 0,8 | 1,6 | 6,4

*) with bar graph
**) using a detector box

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