RLT-Guideline 02

Explosion protection requirements for Air Handling Units

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Including
ATEX- Directive 2014/34/EU
and DIN EN ISO 80079

Herstellerverband Raumlufttechnische Geräte e. V.
AHU Manufacturers Association

Preface

This Guideline should provide a basis for the application of the Directive 2014/34/EU (ATEX Directive) for central air handling units (AHUs). In principle, it should be noted that the ATEX Directive is applicable only for devices that promote a potentially explosive atmosphere or are installed in an explosive atmosphere.

The following statements are based on the text of the ATEX Directive and on the standards mentioned. Conclusions and product-specific interpretations are the result of a discussion in the technical committee of the Manufacturers Association.

This Guideline reflects the accepted rules of technology at the time of creation.

Bietigheim-Bissingen, in August 2019

Herstellerverband Raumlufttechnische Geräte e. V.

This RLT-Guideline can be downloaded free of charge from the homepage of the Herstellerverband Raumlufttechnische Geräte e. V. (www.rlt-geraete.de)

Contents:

1. Introduction to the danger of explosion

AHU equipment must be designed and constructed that any risk of explosion posed by the unit group itself or by gases, liquids, dust, vapours or other substances produced or used, is avoided. For that the manufacturer must take steps to:

- avoid a dangerous concentration of the substances concerned,
- avoid an ignition of explosive atmospheres,
- if it should come to an explosion, to reduce its impact on the environment to a harmless level.

The same precautions must be taken if the manufacturer proposes to use a machine in hazardous atmospheres. The electrical operating equipment installed in the AHUs must comply with the specific guidelines in force with regard to the risk of explosion (quote from the Machinery Directive 2006/42/EC).

2. Application of Directive 2014/34/EU (ATEX Directive)

In general AHU equipment is not subject to the ATEX Directive.

Only, AHUs which are placed in a potentially explosive atmosphere or promote a potentially explosive atmosphere, fall within the scope of ATEX Directive 2014/34/EU. The customer who orders the AHUs must provide the details of the presence of an explosive atmosphere and consequently the necessity of using the ATEX Directive. The manufacturer of the AHUs must construct them in accordance with the specifications of the system installer or planner and mark them according to their conformity assessment.

The definition of the category(ies), gas group and temperature class are done based on the requirements by the above-mentioned criteria. The manufacturer of the AHU cannot afford a zone definition in the context of an overall concept.

AHUs marked in accordance with the EU Directive 2014/34/EU may only be used within the designated use limits (ambient conditions, EX-zone, gas group and temperature class). The requirements of the respective device category shall be observed.

3. Standards and Guidelines

The following guidelines and standards shall be complied with:

Directives:

- EU Directive for equipment and protective systems intended for use in potentially explosive atmospheres (2014/34/EU)
- EU Machinery Directive (2006/42/EC)
- Any other applicable Directives, e.g. EMC Directive (2014/30/EU)

Harmonized European standards:

- ISO 80079-36:2016 "Non-electrical equipment for use in potentially explosive atmospheres -Basis and requirements"
- ISO 80079-37:2016 "Non-electrical equipment for use in explosive areas - Protection by constructional safety "c", control of ignition sources "b", liquid immersion "k"
- EN 1127-1:2011 "Potentially explosive atmospheres - Explosion protection - Basic concepts and methodology - Part 1"
- EN 60079-0:2011+ A11:2013 "Electrical equipment for hazardous areas, general requirements"
- EN 14986:2017 - Design of fans working in potentially explosive atmospheres

European standards:

- EN 1886:2009 "Ventilation for buildings - Central air-conditioning and ventilation equipment - Mechanical properties and methods of measurement"
- EN 1751:2014 "Ventilation for buildings - Air terminal devices -Aerodynamic testing of dampers and valves"
- EN 60079-14:2014 "Explosive atmospheres - Part 14: Electrical installations design, selection and erection"

National standards:

- VDE 0185-305-1 2011-10 Lightning protection - Part 1: "General principles"

National rules:

- TRBS 2152: "Technical rules for operation safety, Part 1 - 4"
- TRGS 727: "Prevention of ignition hazards as a result of electro-static charge"

4. Specific requirements for AHUs

AHUs with explosion protection requirements are generally arranged in accordance with the provisions of Directive 2014/34/EU (European Explosion Protection Directive) in the corresponding category (EX-zone), which distinguishes between the atmosphere in the inner area and the outer area. In principle, the two categories (EX-zones) inside and outside may differ by a maximum of one level. It is necessary to look at both sides, as an AHU always has an unavoidable leak. This is why both zones are defined, especially as an AHU also can be opened and then a zone entrainment may occur.

If no EX-zone has been defined for the outside area, the operator must ensure that the installation area is adequately ventilated, so that when used as intended, no potentially explosive atmosphere can occur due to leakage from the inside to the outside. In the case of an AHU set up outside a zone-freedom can be assumed if in at least two directions along an axis an unobstructed free air flow is guaranteed, i.e. there are no walls or buildings nearby.

Experience shows that this value results in the case of a space installation with an air change rate in the room of 6 changes per hour or higher to a zone reduction of one level in an area of 0.5 metres from the AHU on all sides. Any zone further from the device does not need to be considered. At a lower rate than 6 air changes per hour, the complete installation area is assigned to the corresponding zone.

Normal AHUs on the market (EX-protection devices) correspond to group II (above ground use). Units of Group I (underground operation), need to be considered separately. These are not mentioned in this Directive.

There are the following 3 categories in group II:

- **Category 1/EPL Ga** (corresponds to Zone 0 - Gas):
  The requirements of this category can only be fulfilled with great difficulty, since in the AHU there may be a continuous or long lasting potentially explosive atmosphere. Safety must be ensured even in the event of rare incidents relating to equipment (very high degree of safety). The necessary completely pressure-tight version of the AHU with appropriate safety devices to prevent the explosion propagation serves as an example.
- **Category 2/EPL Gb** (corresponds to Zone 1 - Gas):
  Temporarily or potentially explosive atmospheres may occur. The necessary safety must be ensured during foreseeable faults or defect conditions (high degree of safety).
- **Category 3/EPL Gc** (corresponds to Zone 2 - Gas): Potentially explosive atmospheres can occur only rarely and briefly. Safety must be ensured during normal operation (when used for the purpose intended) (normal degree of safety).

The installer and/or planner of the plant must specify the specifications of the required EX-zone, the gas group and the required temperature class (max. surface temperature in the AHU).

The AHU equipment manufacturer confirms the compliance with the requirements of the basic unit category.

In practice, the AHU manufacturer cannot achieve category 1, since at least two independent protective units must be fitted. For example, this is ensured if the entire AHU in EX-protection version of category 2 is, in addition, designed pressure tight and an explosion spread is prevented across the ventilation ducts by flame arrestors and pressure relief valves or explosion vents. Since the AHU manufacturer cannot afford this very high level of safety, in practice, generally AHUs of category 2 or 3 are used.

To specify the explosion protection target, the gas groups IIA, IIB or IIC must also be determined. All explosion protected units and components used must be suitable for the requested media. A distinction in the declaration must be made between G (gas) and D (dust).

The temperature class of each unit must also be taken into account. The worst-case temperature class of all the devices used determines the temperature class of the entire air conditioning unit. Usually, the temperature classes T1 to T3 are used, but the temperature class T4 with a maximum surface temperature of 135°C can be manufactured with the corresponding components. Higher temperature classes are hardly ever used in practice and economically difficult to achieve. For category 2 AHUs the surface temperature of all parts of the installed equipment in normal operation, and in the event of foreseeable faults, must not exceed the specified temperature limits of the temperature class as specified in EN 80079-36 or EN 60079-0. For category 3 AHUs, the limit temperature of the respective temperature class cannot be exceeded during normal operation.

4.1. Unit housing

- Metallic components of AHUs which are to be operated in hazardous areas must be included in the local equipotential bonding arrangement (e.g. connection to foundation earth), in order to avoid an electrostatic charge. Exposed plastic parts in an EX-zone must comply with the area restrictions as specified in EN 80079-36, Table 8, with a surface resistance < $10^9\,\Omega$ electrostatic discharge or a charge test as specified in EN 80079-36, Annex D should be conducted.
- In decoupled frameworks and parts of the construction, special attention must be paid to the discharge capacity. Doors and covers should also be checked for electrical contact. It may be possible to use equipotential bonding conductors here.
- The fire load of an AHU shall be kept as low as possible to minimize fire hazards and their consequences in the event of an explosion. For this purpose, EN 1886 Chapter 10 must be observed.

4.2. Coatings

- Coatings of metallic surfaces must be conductive with a surface resistance < 10^9 Ω. Alternatively, with gas group IIC, the paint layer thickness should be limited to a maximum of 0.2 mm and with gas group IIB to a maximum of 2 mm.

4.3. Air connections or air openings

- Canvas supports can be electro-statically charged. The surface restrictions for non-conductive parts specified in EN 80079-36 must be observed. In an explosive gas-air atmosphere, within gas groups IIA and IIB, the maximum non-conductive total surface area may not exceed 100 cm^2 and for IIC 20 cm^2 or alternatively, a width of the nozzle of 3 cm for IIA and IIB, and 2 cm for IIC. In practice, these areas are often larger. In this case, the nozzle must be made of conductive material with a surface resistance < 10^9 Ω. The nozzle must be included in the equipotential bonding.

4.4. Covers

- In order to avoid a static charge of the cover door of air control or butterfly valves, the door leaves to the door frame must have a metallic contact with conductive connection elements, such as, for example, by means of metal bushing, metal gears or external linkage.
- For installation of actuators in potentially explosive atmospheres (inside or outside), the actuator must be suitable for the corresponding zone, comply with the requirement of the corresponding category and have a corresponding proof of conformity.
- For potentially explosive atmosphere zone 2 on the inside of the AHU and mounted on the outside of the AHU standard actuators may be used, if it is guaranteed that the enclosure leakage under normal conditions of use does not allow a potentially explosive atmosphere to be carried over to the outside.
- When the outside is a potentially explosive atmosphere zone 2 and installation is internally, standard actuators may also be used.

4.5. Filter unit

- Filters may not be dangerously electrostatically charged by the required air flow. In one zone only filters may be used for which a test report or a component certification is available as specified in Directive 2014/34/EU and use is permitted in the corresponding zone and gas group. The filter is properly installed and electrostatically earthed.
- In the documentation / operating instructions for the unit, the manufacturer must indicate that only filter media approved for the respective application may be used.

4.6. Heat recovery unit

- With heat recovery units it is important to ensure that all conductive metal parts are included in the equipotential bonding measure.
- Electrical components, such as drives must have a suitable proof of conformity for the corresponding EX-zone.
- Drive belts, such as for thermal wheels, shall be made so that they are conductive.
- For more information, see Chapter 4.7.

4.7. Air heater and air cooler unit

- Metallic parts of air heaters are included in the potential compensatory measure.
- Non-conductive parts are subject to the surface restrictions specified in EN 80079-36 or must be designed so they are not chargeable or conductive. In droplet separators plastic slats are therefore to be avoided or the slats must comply with the requirements for non-metallic parts. It is recommended that the coil should be so designed, that the droplet separator should be completely avoided or metal slats should be used.
- The maximum temperature (e.g. in a system that is at a standstill) is to be taken into account in the selection of the temperature class.
- Electric air heaters without proof of conformity should be avoided due to the increased surface temperature and the possibility of formation of electrical sparks.

4.8. Sound attenuators

- Metallic parts of attenuators shall be included in the potential compensatory measure.
- Non-conductive surface parts are subject to the surface restrictions specified in EN 80079-36 or must be designed so they are not chargeable or conductive.

4.9. Humidifier unit

- Metallic parts of air heaters shall be included in the potential compensatory measure.
- Non-conductive parts such as droplet separators, rectifiers, evaporation bodies, etc. are subject to the surface restrictions specified in EN 80079-36, or must be designed so they are not chargeable or conductive.
- Electrical components, such as pumps, valves, etc. must have a suitable proof of conformity for the corresponding zone.
- Steam humidifiers and steam generators without adequate proof of conformity are to be avoided due to the increased temperatures and the possibility of electrical sparks.

4.10. Fan unit

- The fan must be fitted with appropriate identification. A corresponding proof of conformity for use / the conveyance of hazardous atmospheres of zone 1 thus EX II 2G or zone 2 with EX II 3G. To do this, the temperature class must be specified, e.g. T3 = maximum 200°C surface temperature.
- Usually, the fan in EX-version is designed to run at only 80% of its maximum speed in order to reduce the vibration problems and the mechanical load on the wheel.

- To avoid the risk of ignition, fans are usually supplied with an inlet nozzle, which offers an optimized material combination, in order to minimize the risk of a sliding contact being a source of ignition.
- EX-protected fans shall be protected against objects falling or being sucked into them as specified in EN 14986. If the function is required, upstream components, such as heat exchangers, can be considered as intake protection.
- In general, directly driven fans have advantages with EX-protection, because there is no need for belts which may be a source of ignition. In the case of belt-driven fans there are higher risks from the belt itself, because slipping can produce raised ignition temperatures, and thus, is a potential ignition source in itself. If, nevertheless a belt-driven fan is used, the fan belt must be electrically conductive, in order to avoid a static charge.
- The European standard EN 14986 specifies the structural requirements for fans of group II G (the explosion groups IIA, IIB and hydrogen) categories 1, 2 and 3 and Group II D categories 2 and 3 for use in potentially explosive atmospheres.

4.11. Electrical components

- All electrical components should be chosen in accordance with the target zone, the temperature class and the medium used (gas group). Only equipment with the appropriate marking must be used. Here attention must be paid to the documentation (CE manufacturer's declaration, etc.). Electrical equipment without effective protection measures are a possible ignition source, due to electrically generated sparks and potentially hot surfaces. This applies, for example, for motors, switches, screwed joints, lamps, etc.
- Motors that cannot be controlled must be designed with "increased safety (EX e)" as specified in EN 60079-14.
- Controllable motors must be designed with a suitable type of protection (e.g. EX d pressure tight encapsulation, EX e - increased security or EX nA - Non-sparking [Cat 3]). The direct temperature monitoring must be done by an external motor protection (e.g. PTC resistor) with the appropriate proof of conformity or motor, inverter and protective equipment all tested together.
  The appropriate protection of motors in EX areas must be observed. For this purpose, appropriate overload relays or sufficiently reliable temperature sensors must be installed. In the case of variable-speed motors, the monitoring devices must be adjusted to the significantly extended work area. In the EX area certified Ex-d-motors are selected for the operation of the motor on the Inverter allowing the motor to be combined with any Inverter. The necessary monitoring is carried out with PTC thermistors in the winding and a certified tripping device. The certification of motors in other types of ignition protection is narrower and more complicated; since it must be ensured that the peculiarities of different inverters have no effect on the temperature behaviour of the motors. In general, the motors for the ignition protection types EX e and EX nA motor and inverter are certified only as a unit, which makes a change more difficult or ruled it out completely.
- Inverters are direct control and regulating units. If the Inverter is mounted outside a zone and controls a motor within a zone, the manufacturer must confirm that the Inverter is fail-safe and in case of incidents does not exceed the planned speed. Too high frequency (= speed) can result in damage to the fan / motor and thus to the formation of an active ignition source.
- Non-metallic pipes up to 3 cm diameter can be processed in the EX zones 1 and 2, gas group IIB. For gas group IIC the diameter is 2 cm. Larger pipes for cable routing shall be made of metal, that is conductive and grounded. The length of the cable routing plays no role at all.
- Cables and wires must comply with the requirements of Section 9 of EN 60079-14. They must be suitable for the specified temperature and the intended purpose. In the event of an aggressive atmosphere, special wires and cables shall be used, for example, oil or fuel-resistant cables.
- In the case of electrical components within a zone, cable glands and plugs shall be used with the appropriate proof of conformity.
- If no intrinsically safe circuit exists, all cables of an AHU should be taken together to the control panel. A separation from other cables and systems is not necessary either in the supply or in the control panel.
- During the installation of intrinsically safe circuits, special requirements need to be complied with (see, for example, EN 60079-14). The principle of intrinsic safety is based on the fact that a hazardous environment cannot be ignited if the safe limiting energy values in the power circuit are not exceeded, even if there is an open circuit, short circuit or earth of the electric circuit. Intrinsically safe circuits must be marked by blue lines or equivalent and can be combined in the control panel. In systems with intrinsically safe circuits for the Ex zones 1 or 2, the intrinsically safe equipment and parts of associated electrical equipment must at least comply with category "ib" specified in EN 60079-11.
- Cables and wires, which contain intrinsically safe circuits, must be marked to show they are part of an intrinsically safe circuit. If coatings or wrappings are marked by a colour, the colour light blue must be used. Where intrinsically safe circuits were marked by the use of light blue jacketed cables and wires, light blue jacketed cables and wires must not be used for other purposes or used in a manner or at a point, which could lead to confusion or have a negative effect on the marking of intrinsically safe circuits. If all intrinsically safe or non-intrinsically safe cables and wires are reinforced, metal coated or screened, then the marking of intrinsically safe cables and wires, as well as a separate laying, is not required.

4.12. Lightning protection

- EX-protected AHUs for outdoor installation must be equipped with a suitable lightning protection system, in which all the metal parts of the construction (ladders, platforms, etc.) are connected with the earth conductors. AHUs can, however, be considered as continuous metal constructions and should therefore be treated as their own lightning protection system.
- It is necessary to verify in each individual case which standards should be applied and what aspects must be observed for lightning protection of AHUs.
- Since the use of metallic components with internal components (ducts, pipes, etc.) are not allowed for the dissipation of lightning currents, the metal fixtures must be located in the roof area to avoid direct strikes in the protection area of arresting devices (lightening conductors, air terminal rods). To prevent flash-overs and proximetry between the metal fixtures and the arresting devices of the lightning protection system, the installations should be bonded as specified in VDE 0185305 Part 1 in the lightning protection equipotential.

4.13. Rating plate and data sheets

- The project limits and specific limits of use (see also Chapter 7) shall be given on the data sheet and rating plate.

4.14. Operating and servicing manual

- The operating and servicing manual of the manufacturer must include suitable instructions and consider the necessary work required to set up and fit the AHUs. In particular, the expert integration of the AHU into the protective conductor system, the equipotential bonding, grounding and lightning protection must be taken into account. The manual must describe the servicing and operation from the explosion protection point of view.
- In addition, the general use limits (temperatures, differential pressures, speeds, currents, voltages, etc.) must be given in the operating and servicing manual or referred to on product rating plates and data sheets.
- The operating and service manual must contain all the danger and safety information for servicing and for the intended operation.

4.15. Servicing and repair

- Servicing and repair work may only be carried out by appropriately trained staff.
- Work may only be carried out in zone freedom or by avoidance of ignition sources. It is particularly important to make sure that all work equipment is approved for the corresponding zone (see EN 1127-1 Appendix A and TRBS 2152).
- Before opening the AHU, the plant must be put out of order mechanically and electrically, secured against being switched on again and marked.
- In addition, it may be necessary to flush the system with fresh air in order to remove or dilute a potentially explosive atmosphere.
- When the system is shut down, the concentration of the atmosphere can change and thus increase the risk of explosion. Therefore, during servicing all kinds of ignition sources need to be avoided. It may be necessary prior to the start of the work, and possibly also during the work, to make measurements with a gas measuring device.

4.16. Zone reduction

Zone reduction between fresh air and room to be ventilated:

- A reduction of the zones of the room to be ventilated with fresh air of around one zone is possible if a current free closing airtight damper as specified in EN 1751 class C (3) is fitted at the fresh air outlet. This must be closed when the fresh air fan is switched off to prevent backflow. In order to avoid a carry-over from the exhaust air to the fresh air, the minimum distance between the fresh air intake and outlet from edge to edge at all points must be at least 2 metres.

Zone reduction by plates and rotary heat exchangers:

- If the fresh air fan is pressurising, the exhaust fan sucking and the plate heat exchanger is in the direction of air flow behind the fresh air fan and in front of the exhaust fan, then it is possible to reduce the zone by one by complying with 5.6. In order to avoid a carry-over from the exhaust air to the fresh air, the minimum distance between the fresh air intake and outlet of the unit from edge to edge at all points must be at least 2 metres.
- For all other arrangements in conjunction with plate heat exchangers, as well as generally for rotary heat exchangers, a zone reduction is not possible.

Zone reduction in recirculation mode:

- A zone reduction with recirculation operation is generally not possible.
- The zone can be reduced by one, if the recirculation damper specified in EN 1751 is at least class C or 3 when EX-operation function monitor is closed and remains closed as well as current free. Recirculation mode is only permitted, if there is no danger of the occurrence of a potentially explosive atmosphere, i.e. in the case of zone freedom.

4.17. AHUs for the gas group IIC

- On AHUs for the gas group IIC special attention must be given to ensure, that the requirements for plastic surfaces and paint thicknesses, as well as filters for gas group IIC as specified in EN 80079-36 are fulfilled and all electrical devices have an authorisation for gas group IIC. Since there are no fans available for the complete gas group IIC, in addition to the exhaust and, if necessary, in the fresh air a BGRCI listed explosion-proof gas warning device must be installed. At 20% of the lower explosion limit or less an alarm must be triggered. Upon reaching 40% of the lower explosion limit or less the air conditioning unit must be completely turned off automatically and may not be turned on.

5. Evaluation of ignition sources

The individual ignition sources for AHUs must be evaluated. The following Table 1 gives an example of the assessment in a highly condensed tabular evaluation.

Table 1: Example of a simplified analysis of ignition sources

	The danger of ignition		Applied protection measure to prevent the entry into force	
No.	**Potential ignition source**	**Cause, description, occurrence**	**Description of the protective measure**	**Verification** (Manufacturer-specific)
1	Enclosure leakage	Zone carry over (inside/outside) ***common***	Through the not preventable leakage differentiates, the inner and outer zones may differ by a maximum of one.	
2	Recirculation	Zone spread (intake and exhaust) ***rare***	Recirculation can only be used if the zoning of fresh air and exhaust air is identical. Also applies to the assessment of leakage between the fresh and exhaust air (e.g. heat recovery device).	
3	Electrical components	Electrical spark ignition ***common***	Use of the corresponding components for the zone.	
4	Drive motor	Electrical spark ignition ***common***	Use of the corresponding equipment and components for the zone. When operating with a frequency converter, the motor must be enclosed in a pressure tight casing.	
5	Fan	Grinding of the nozzle, foreign items drawn in ***rare***	Use of the corresponding equipment and components of the zone: - nozzle with slip ring - intake protection to prevent foreign material being drawn in - reduction of the maximum speed - setting nozzle gap with note in the instructions	
6	Inverter	No explosion protection possible ***common***	Will only be supplied loose and not used in a hazardous zone.	
7	Unit housing	Electrostatic charge ***common***	All metal parts of the construction will be included in the local potential equalisation measure. Use of electrically conducting coatings. Adoption of the specification in the manual that the entire device must be earthed, bonded into the protective conductor system and connected to the equipotential bonding system.	
8	All components	Elevated temperature ***rare***	The use of the appropriate temperature classes and limiting the maximum operating temperatures.	
9	Air control and locking dampers	Electrostatic charge ***common***	All metal parts of the construction are connected with the protective conductor system (e.g. the use of a conductive rod).	
10	Sound attenuator	Electrostatic charge ***common***	Cover the absorption surface with perforated sheet metal or a knitted metal (integration into the protective conductor system).	
11	Lightning strike	Ignition spark / charge ***rare***	If there is a roof central intake the default is to install a suitable lightning protection system (particularly in the case of an outdoor installation).	
12	Electric air heater	Resistance heating (increased temp., etc.) ***Very rare***	Electric air heaters can only be used if you have an appropriate ATEX approval and all the prescribed monitoring functions are present.	
13	Droplet separator	Static charge ***rare***	Using plastic plates is forbidden or using conductive plastic plates and integration into device potential; Use of metal plates; pay attention to speed limit.	
14	Canvas support	Static charge ***common***	Use forbidden or appropriate STS conductive with proof / certificate Use of MPS nozzles.	
15	Plastics in the zone	Static charge ***common***	Minimize use, for example, no empty plastic pipes or conductive plastics and inclusion in device bonding.	
16	Belt-driven fans	Static charge; electrical isolation between motor and fan ***rare***	Minimize use, e.g. directly-driven fans.	
17	Dusts	Explosion hazard, degree of dispersion ***common***	Use of filters in accordance with quality class (min. fine dust filter) in the presence of explosive dusts.	
18	Steam humidifier	High temperature ***rare***	Avoid use or permitted only if manufacturers can present a marking of the corresponding class.	
19	Filter	Static charge ***common***	Use of EX protection filters with a surface resistivity of < 10^9 Ω and metallic frame, which is connected with the protective conductor system.	

6. Marking

AHUs with a special explosion protection may only be used in the declared category. The marking is located on the fan chamber of the AHU. This distinguishes the marking required between the inside (conveyed atmosphere) and outside (installation area).

6.1. Temperature classes and explosion groups for gases

The hazard (ignition sensitivity) of gases and vapours increases from group IIA to IIC.

Table 2: Temperature classes for gases

Temperature class	Maximum surface temperature	Notes
T (x)		
T 1	450°C	
T 2	300°C	
T 3	200°C	The common class
T 4	135°C	High effort
T 5	100°C	Practically insignificant
T 6	85°C	Practically insignificant

Table 3: Gas groups for gases

Gas group	Notes
II(y)	
IIA	Commonly the case
IIB	Rare
IIC	With gas measuring equipment

Table 4: Temperature classes and explosion groups (EN 60079-0) for gases

Temperature class 1)	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Max. surface temperature [°C] 2)	**450**	**300**	**200**	**135**	**100**	**85**
Group **IIA**	Acetone ammonia benzene acetic acid ethane ethyl acetate carbon monoxide methane methanol methyl chloride naphthalene phenol propane toluene	cyclohexanon acetic-acid-anhydride n-butane n-butyl alcohol	Gasoline diesel fuels aviation fuels heating fuels n-hexane	acetaldehyde		
Group **IIB**	town gas	ethyl alcohol ethylene	hydrogen sulphide ethylene glycol	ethyl ether		
Group **IIC**	hydrogen	acetylene				carbon disulphide

1) Air inlet temperature fan / motor max 60°C; ambient temperature up to 40°C
2) Values already contain a safety distance to the lowest ignition temperature of the explosive atmosphere

Use of AHUs is only possible in conjunction with other measures, e.g. special explosion-protected equipment, as well as gas measuring equipment.

Use of AHUs of appropriate design possible.

6.2. Example of an equipment identification

An AHU for use in an EX zone must be identified.

The temperature class and gas group assignment inside and outside are always the same.

Hereinafter following two examples:

Ex II 2G IIB T4 Gb (inside) is:

Ex = Ex mark to avoid explosions
II = device group (above ground use)
2 = protection category 2
G = gas / D = dust
IIB = explosion group II B of the substances transported (gas group IIB, see Table 3)
T 4 = temperature class = 135°C maximum surface temperature of all components
Gb = Equipment protection level Gb, control of potential ignition sources in normal operation and in case of failure of the device

Ex II 3G IIA T4 Gc (outside) is:

Ex = Ex mark to avoid explosions
II = device group (above ground use)
3 = protection category 3
G = gas / D = dust
IIA = explosion group II A of the substances transported (gas group IIA, see Table 3)
T 4 = temperature class = 135°C maximum surface temperature of all components
Gc = equipment protection level Gc, control of potential ignition sources in normal operation of the device

A warning message should be placed on the device, for example, this might read:
"The device can promote a potentially explosive atmosphere. Must only be opened by qualified staff with appropriate work equipment!".

6.3. Versions of the equipment identification

The marking corresponds to the table below. A higher number increases the level of security. Version 1 offers the lowest EX protection while version 6 offers the highest protection. It may be necessary to mark supply and exhaust air separately.

Table 5: Possible versions of the explosion protection equipment marking

Variant	Interior	External	Notes
Variant 1	Ex II 3 G II(y) T (x) Gc	./.	Internal EX-protected (normal degree of safety)
Variant 2	./.	Ex II 3 G II(y) T (x) Gc	External EX-protected (normal degree of safety)
Variant 3	Ex II 3 G II(y) T (x) Gc	Ex II 3 G II(y) T (x) Gc	Internal and external EX-protected (normal degree of safety)
Variant 4	Ex II 2 G II(y) T (x) Gb	Ex II 3 G II(y) T (x) Gc	High degree of security inside / outside normal degree of safety
Variant 5	Ex II 3 G II(y) T (x) Gc	Ex II 2 G II(y) T (x) Gb	High degree of safety outside / inside normal degree of safety
Variant 6	Ex II 2 G II(y) T (x) Gb	Ex II 2 G II(y) T (x) Gb	A high degree of safety outside and inside

Table 6: Comparison of zone

Zone	Explanation	Category / equipment Protection level	Explanation
0	Potentially explosive atmosphere permanently present	1 / Ga	Safety in normal operation, in the event of a failure, in the rare event of a failure / on two independent failures
1	Potentially explosive atmosphere occasionally present	2 / Gb	Safety in normal operation and in case of failure
2	Potentially explosive atmosphere may only occur seldom and only for a short period of time	3 / Gc	Safety in normal operation

7. Conformity declaration

In accordance with Directive 2014/34/EU, the assessment of the risk of explosion shall be done by the manufacturer of the AHU based on a risk analysis. The manufacturer may, in addition, get a notified body to check the conformity of a representative sample by a conformity test.

In this procedure for category 2 (AHU group II) a conformity test is done and after a positive conclusion a certificate issued in accordance with Annex VIII. The manufacturer commits to build his product exactly according to the audited and certified documents.

Alternatively, the manufacturer can also ensure compliance with the directive by an internal control of production as specified in Annex VIII (see Figure 1). In addition, the entire manufacturer's documentation must be filed with a notified body. In addition to the filing, the notified body will produce a test certificate.

As specified in Directive 2014/34/EU the following documents must be filed:

- Risk analysis as specified in EN 1127-1 (for complicated devices)
- Tabular evaluation of the ignition hazards as specified in EN 80079-36
- A general description of the device / devices
- Conceptual designs and manufacturing drawings and diagrams of components, installation documents, etc.
- Descriptions and explanations necessary to understand the drawings and diagrams mentioned and the operation of the devices are required
- A list of the standards applied in full or in part, as well as a description of the solutions adopted to meet the safety aspects of the Directive where the standards have not been applied
- The results of the design calculations, tests, etc.
- Test reports
- Conformity declaration

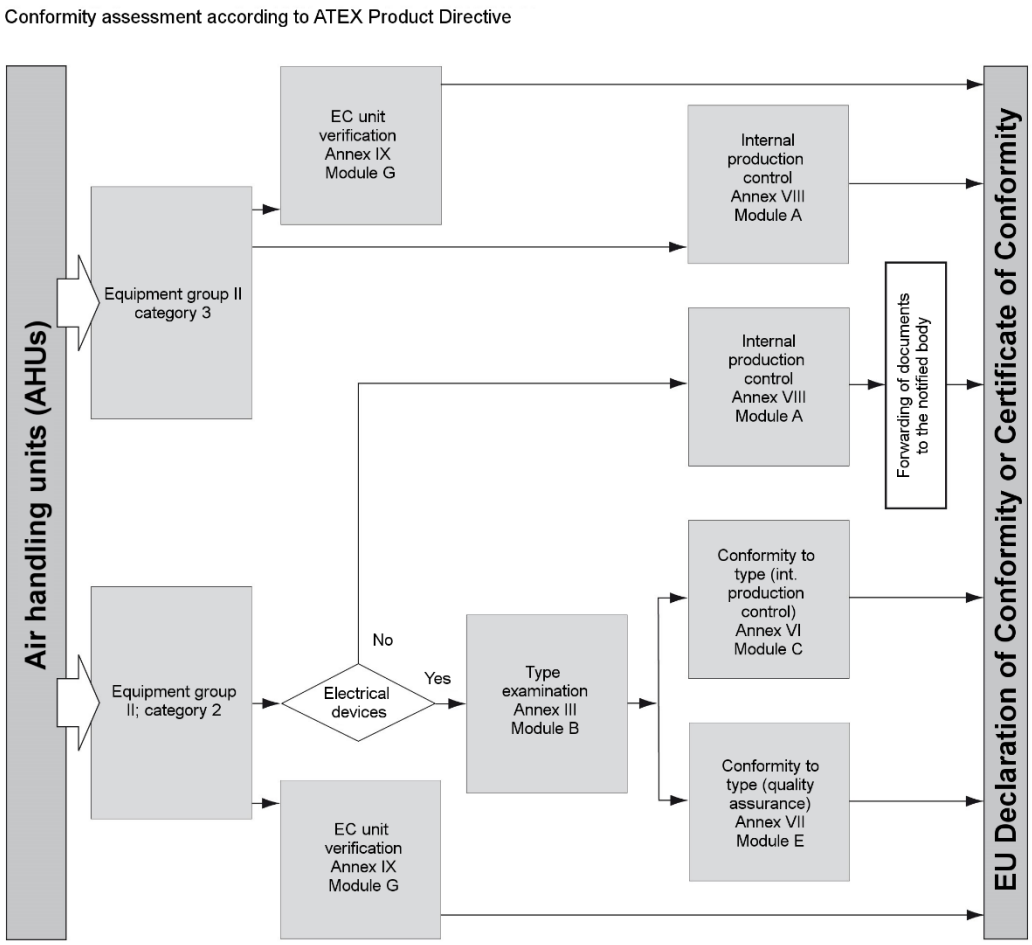

Figure 1: Conformity assessment procedures

8. Summary

An AHU alone cannot ensure the full and necessary explosion protection. The protection concept must always take into account the entire plant and further circumstances.

The overall responsibility for the correct assembly, proper use, servicing and repair always lies with the system builder and operator of the complete plant.

According to Directive 2014/34/EU Explosion protected AHUs must be marked. The minimum requirements of the marking are set out in Annex II, Section 1.0.5 of the EU Directive. The product must only be used in accordance with the specified EX-marking inside and outside in accordance with the instructions in the operating and maintenance instructions.

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