



EXPLOSION PROTECTION AND OPERATIONAL SAFETY

With OktaLine ATEX, Pfeiffer Vacuum sets an example in terms of the safety standard

Safety first - this principle is paramount in all areas where people are exposed to risks that could be potentially dangerous to them. This is not only relevant in air and road traffic, but also in many industrial production sites and in the operation of a variety of process plants. Particularly for processes where there is a potentially explosive atmosphere, in-depth measures are necessary to ensure the safety of all people working there.

For this reason, the European Union adopted the ATEX 94/9/EC directive, which defines the laws concerning equipment

and protective systems intended for use in potentially explosive atmospheres. It contains the regulations for placing products on the market that are used in potentially explosive areas, and it also applies for non-electrical equipment.

Pfeiffer Vacuum has made the ATEX directive the basis for its product development and set new standards in terms of safety and risk mitigation.

The ATEX directive at a glance

The basis for implementing the ATEX directive in the products is a comprehensive risk analysis. This analysis mainly consists of evaluating the ignition hazard according to the EN 13463-1

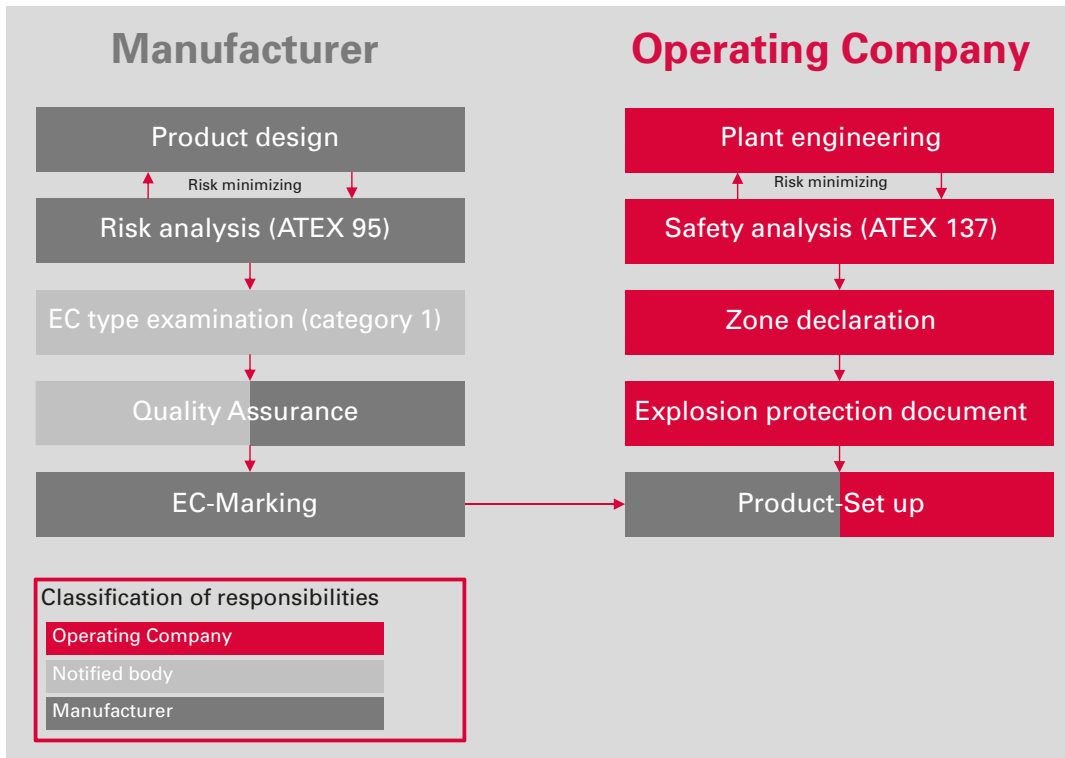


Figure 1: Responsibilities according to explosion protection directives

To assess the safety level of a device, there are several categories that define when, and to what extent, the equipment must be safe.

Category 3: The safety of the device must be ensured during normal operation.

Category 2: The safety of the device must be ensured if an expected malfunction occurs.

Category 1: The safety of the device must be ensured if two independent expected malfunctions occur or a rare malfunction occurs.

New quality and safety standards on the market: OktaLine ATEX

Pfeiffer Vacuum has made the aspects of the ATEX directive and the manufacturer's obligations concerning risk analysis and assessment of ignition hazards, the basis for further development of its proven Roots pump principle. The result: the OktaLine ATEX.

standard. The manufacturer of a non-electrical device is obligated to assess whether one or more of the following ignition sources may occur in the device:

- Hot surfaces
- Flames and hot gases (including hot particles)
- Mechanically generated sparks
- Electrical ignition sources
- Electrical stray currents
- Static electricity
- Electromagnetic waves
- Ionizing radiation
- Ultrasound
- Adiabatic compression and shockwaves
- Exothermic reactions

These are all potential sources of ignition. If in the context of the risk analysis, it is determined that one or more potential sources of ignition occur in a device, it is called "device-related sources of ignition". In the worst case scenario, they can create "effective ignition sources" which, together with oxygen and the combustible material, cause an explosion. This must therefore be prevented with targeted measures.

After assessing the ignition hazards, the manufacturer must take appropriate measures to prevent the occurrence of effective ignition sources.

This magnetically coupled Roots pump is a global innovation. For the first time, it combines a magnetic coupling with category 2 or 3 explosion protection. However, in the design of vacuum pumps, potential ignition sources cannot be completely avoided. For example, due to the heat of compression, which occurs in practically every pump, it cannot be prevented that pump surfaces heat up during operation.

Pfeiffer Vacuum has made it its mission to ensure that any potential ignition sources that cannot be excluded are designed in such a way that they will not become effective. For example, the surface temperature must not exceed the limits of the respective temperature class. Therefore, the OktaLine has a temperature sensor which performs continuous measurements to ensure that the limits are adhered to. In addition, the ATEX series pumps are equipped with a housing that can withstand up to 1,600 kPa of internal pressure. Each pump is tested for this by Pfeiffer Vacuum experts before it is delivered.

By incorporating the magnetic coupling, pumps in the OktaLine ATEX series are hermetically sealed. Their extremely low leak rate of not more than $1 \cdot 10^{-6}$ Pa m³/s also ensures additional safety as it prevents a zone entrainment between the process related internal and external atmosphere ¹⁾. In addition, the shaft sealing rings, which are inherent weak points with pressure surges and require high-maintenance, were omitted. This allows the OktaLine ATEX to have long intervals between maintenance.

Thanks to the high quality standards in production and decades of experience by Pfeiffer Vacuum in the development and construction of Roots pumps, the manufacturer guarantees maximum safety for its product. The OktaLine ATEX series is therefore the ideal solution for processes that take place in a potentially explosive atmosphere. A pleasing and efficient spin-off of this is that, due to the frictionless operation of the rotors, a technically dry operation is ensured. The air cooling system requires significantly less energy than a water cooling system, and this reduces operating costs significantly.

Throughout the production phase, with the ATEX series, all safety-relevant parameters are determined and documented for each single pump. If the pump is used for the intended purpose, the occurrence of sparks, for example, can be ruled out.

The new OktaLine is excellent for the evacuation of explosive gases in accordance with the ATEX directive. It can be used in various applications, such as in chemical and process engineering, in industrial applications, in coating, in the semiconductor industry and in research & development. All pumps in this series are suitable for temperature class T3 and cover pumping speeds from 280 m³/h to 5,190 m³/h.

What is different about the ATEX version?

Compared to the standard version of OktaLine Roots pumps, the ATEX version has some modifications to ensure their compatibility with the ATEX directive. For example, the integrated temperature sensor of the ATEX pump is designed with redundancy so that temperature measurement is ensured under all circumstances and despite any complications during the process.

¹⁾ A zone entrainment is a risk created, for example, by leaks of explosive mixtures that may escape from the pump. As a result, the internal explosion zone is carried over to the outside where the system operator does not generally expect any explosive mixtures. The risk potential is therefore increased accordingly. Due to the magnetic coupling with its small leakage rate, the explosion risk is significantly minimized.

Instead of a PEEK split case, the ATEX pumps have a ceramic split case which is coated on both sides. The coating prevents an electrostatic charge from building up at the split case and also averts the risk of ignitable sparks due to the discharge.

The magnetic coupling incorporated in the ATEX version, and the motor, are both fully compliant with the directive. To prevent sparking due to the rapid collision of the gray cast iron materials, the overflow valve in the OktaLine ATEX is blocked. At the request of the customer, other materials can also be used and the valve can be opened again.

The rotors of the ATEX version are slightly shortened compared to the standard version. Thus, larger clearances can be implemented, which significantly contributes to enhancing explosion protection, particularly in the case of a power outage, so if the pump suddenly shuts off, the housing cools down faster than the piston. The pistons are then still in the expanded state, while the housing shrinks again – this results in small clearances that can lead to sparking. With the higher clearances generated by the shortened rotor, the pump can be started right away after a power outage, without creating a potential ignition source.

The material of the sight glass in the pump was changed in such a way, that it passes the required impact test of the EN 13463.

Furthermore, far more elaborate inspections are carried out during production, during which the different tolerances for the parts and components are identified and documented.

The advantages of OktaLine ATEX at a glance:

- Extremely high operating reliability
- ATEX-compliant
- Low maintenance
- Pressure surge protected
- Low operating costs
- No zone entrainment between process related internal and external atmospheres
- Highest quality standards in materials and construction



Figure 2: The OktaLine ATEX by Pfeiffer Vacuum

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Pfeiffer Vacuum GmbH
Headquarters · Germany
T +49 6441 802-0
info@pfeiffer-vacuum.de

www.pfeiffer-vacuum.com

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